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Electric Railway Shops Are Behind the Times

A SILENT and little known but vitally important element that contributes much to the success or failure of the electric railway is the car repair shop. Even the management of the road is not always conscious of the part it plays in rendering adequate and reliable service at all times and under all conditions.

In the past few years attention of managements has been focused on the necessity for the use of modern, light-weight equipment. This has proved a good investment in practically every case, and a good advertisement for the railway purchasing it.

Often it is argued that the new cars require less maintenance, and so it is not necessary to have as complete shop equipment as for the older types of cars. There is a fallacy in this. Since the new cars almost invariably represent a much greater investment than the ones they replace, and since they have a greater earning power than their predecessors, it is doubly important that they be kept in active service as great a portion of the time as possible. While the repairs when the cars are brand new may be minor, the excellence with which the work is done at that time will determine to a considerable extent how long they can go without undergoing heavy repairs.

Modern shop equipment is available that makes it possible to handle the cars in the shop much more quickly, and to do the necessary repair work with far greater facility and at less cost, than the equipment used by past generations. Yet many shops are using tools that were purchased twenty or more years ago. In fact, in the survey carried out by the ELECTRIC RAILWAY JOURNAL and published in this issue, it was developed that but one-third of the shop tools of small, medium-sized and large properties were less than ten years old.

When it is considered that the period beginning with the commencement of the World War ten years ago has seen a most remarkable improvement of machine tools, particularly along the lines of more rapid production and greater precision of work, this statement indicates that the electric railway shops are even more out of date than is gathered from the figures alone.

The responsibility for this rests partly with the master mechanics, but in a larger measure with the executives who as a rule have listened with a deaf ear to the proposals of the master mechanics for expenditures for modern machine tools in order to reduce maintenance costs. The executives' excuse has been lack of money, but it is believed that that is no longer a good reason. Almost any railway can buy a machine or two a year, at least under present conditions, and gradually place the shop in position to reap the economies that modern tools make possible. For the fear that the electric railway was to be supplanted has passed. We know now that the bus is a supplement, not a substitute. So with this former deterrent out of the way, the shop's modernization program can get under way.

What the Survey of Machine Tools Developed

IT WAS typical of the answers submitted in reply to the questions upon which the JOURNAL'S survey of machine tools in electric railway shops was based, that most of the machine tools were old and few modern and efficient. In fact, some reports listed tools in service that were purchased as much as forty years ago—tools that actually antedate the electric railway itself. Other tools were of uncertain origin, having been in the shops so long that the present management knows nothing of the time or place of their purchase.

Still other replies indicated that second-hand tools had been bought in quantity. Most likely these tools, which had served their purpose for the original purchaser, were already worn or were unsuited to the work for which the road obtained them. Possibly the managements taking this action thought that great care had been used in the selection of the shop equipment, and that considerable money had been saved by getting something "just as good as new." Such tools might be a wise buy as a temporary substitute for the proper equipment, if the roads had not the money at the time to purchase modern equipment. But when such tools are continued in use for many years without thought of replacement, it does not indicate that the management has a clear idea of the functions of the mechanical department or of its importance in relation to the net earnings of the road.

Use the Shop Equipment to Good Advantage

PROBABLY the one thing that has been impressed on the shop foreman of the electric railway more than any other is the importance of getting the cars out of the shop without delay. A car in the shop earns nothing, and it is the car, not the shop, that makes the profits.

This attitude frequently has led to practices that are not efficient or economical. If the shop is not equipped with the proper machine tools, or if the tools best fitted to the job are busy on some other work, that is unfortunate, but the car must be turned out somehow! In this way it frequently happens that it is necessary to spend more money and do the work uneconomically and in a makeshift way.

There is a great difference between the electric railway repair shop and the manufacturing plant. While

conditions such as those referred to exist in many railway shops, a manufacturing shop must make its products economically or else profits disappear and the factory goes out of business. With proper equipment and organization, however, it is possible to approximate manufacturing shop conditions in the railway repair shop.

The study of machine tool equipment made by this paper points the way to the selection of new, profit saving machines. That helps in one way to get shop costs down. Another remedial measure is to take steps to provide the older machines with modern cutting tools, as far as their strength and power will stand it. The correct form of tool, the proper material for the working part to get the most out of the machine, and the proper adjustment and grinding of the cutting edge, are all necessary. These are things that require little or no capital expenditure, but do take knowledge and skill on the part of the supervisory force.

Another element in reducing shop costs and getting production is a study of the work done in the shop. Nearly every electric railway has forms to be filled out, giving the individual cars held out of service and the reasons therefor. One car will be held for wheels, one for a broken equalizer bar, a third for journal brasses, etc. Of course, any railway with the least semblance of organization has on hand sufficient wheels, brasses, or material for equalizer bars. The real reason for the long periods in which cars are held out of service is not lack of material. It is that the organization, or the machinery, or the tools are in such condition that the necessary machine work cannot be done promptly. Here is where a live equipment man can well afford to devote his attention and determine just where the difficulties are that must be remedied to get the cars out of the shop.

Then the story must be put in proper shape and presented to the general manager in such form that it is a convincing argument for the proper action. Even though the manager does not see his way clear to purchase the much needed equipment and throw out the old machines, it will be to his advantage to know the real condition of his shop and to determine what improvements can be made now or in the near future that will gradually better conditions. More than likely the idea cannot be "sold" by the equipment man the first time, but repetition is necessary and ought ultimately to bring an O.K. Salesmen do not get their orders at the first call, usually, but have to come back again and again. The master mechanics have a selling job to do.

Keeping Records of Machine Tools

IN COLLECTING data relative to the machine tools used in electric railway shops a lack of records of this equipment was found. Some properties had lists of the tools, others had a card index of the machines with their location, type and size, detail dimensions, age, etc. But the majority of properties rely on the memory of someone, usually the master mechanic, for the authentic information as to what this or that machine is and its controlling dimensions and characteristics. This means, of course, that any question arising with regard to a machine can be answered only by taking the data off the machine itself—a practice that makes for delay.

A detailed record of each machine, made at the time it is installed, will facilitate inventories and lend intelligence generally to the use of the machine during its full life.

Rising Labor Costs Make Handling Machines Necessary

WE IN THE United States are justly proud of our high standards of living compared with those in other countries, and we speak with satisfaction of the enviable economic status of the American workman. The present situation is the result of a steady trend toward higher wages and shorter hours, a trend which has continued almost without interruption for many years, but especially since 1914.

In the abstract, this tendency is approved by nearly everyone. In concrete cases, however, approval is likely to be tempered by dismay at the increased labor costs. When increased wages and shorter hours can be arranged without making production more expensive, little opposition is encountered. The development of modern machinery has often made this possible.

In recent years the problem of rising wages has made construction and operating costs an acute problem in the electric railway industry. In the transportation department this has been solved to some extent by the one-man car, and by other means. In the shop, way, and line departments special handling machinery has made the time of the laborer more productive.

Great strides have been taken in this direction during the past few years. Observation on many properties shows that railways have been buying labor-saving machinery of nearly every description, and have found the investment to be well justified by the resultant saving in man-hours.

The collection of pictures from various parts of the country published in an eight-page group in this issue gives one an idea of the scope of materials handling machines which are applicable in the various departments of the electric railway field. Railways have had to conserve their earnings because they could not readily or materially increase their selling price, and this accounts for the great interest in labor-saving machines—an interest that is gaining headway rapidly as experience accumulates to show the savings possible.

An Urge from Headquarters May Improve Publicity

GOOD publicity is considered both necessary and helpful in building better public relations, yet there are many electric railway managements, even at this late date, who are not taking any part in the work. President Budd of the American Electric Railway Association recently said, in speaking to the Midyear Meeting at St. Louis, that any manager who is not doing his share in the general program of public relations work is derelict in his duty to his company and to the industry.

This lack of co-operation might be remedied in many localities if the suggestion were sent out from the main office to the local managers that they should report back periodically as to what they have been doing along these lines. In other words, there has not been the urge from the main office to do these things in many instances. On the other hand, every local manager should insist upon an appropriation for the purpose of executing locally his part in the general program to get a square deal for the electric railways.

40% Are Over 20 Years Old

Only 28% of All Machine Tools Now in Use in Electric Railway Shops Have Been Purchased in the Last Ten Years—"Journal's" Survey of Conditions Shows that at Least 12,500 New Machine Tools Are Needed to Approach Modernization in This Department of the Industry

TO MODERNIZE electric railway shops in the United States, 12,500 new machine tools, including woodworking machines, are needed as a minimum. This is based on the assumption that at the very least all machine tools over 20 years old ought to be replaced. The number of such tools in the shops of the 821 electric railway operating companies is about 10,000, which is 40 per cent of the total number of machine tools of all ages in use in the industry. In addition, 2,500 more new machine tools are required to meet the expressed need of the master mechanics for new tools to supplement their present equipment.

This is believed to be a conservative estimate, because many machines less than 20 years old ought to be replaced too, and because many more new additional machine tools are needed than 2,500, as this number is based on a literal interpretation of the fact that no information on this point was supplied by 53 per cent of the master mechanics reporting.

Such a program as this of new machine tools would require expenditures aggregating some $15,000,000 to $20,000,000, which indicates the magnitude of the task that must be accomplished in modernizing the rolling stock maintenance facilities of the industry. As it is generally conceded that substantial economies are readily possible and would result from such a program, one may get an idea from the figures just read of the magnitude of the savings that are available. Or, to put it another way, one gets some appreciation of the losses which electric railways are suffering by continuing the use of the present obsolete, inefficient and small capacity machine tools.

Having known for a long time, but in a general way, that electric railway shops are very poorly equipped on the average, the JOURNAL undertook for this Annual Maintenance Number to derive a definite measure of how well or how poorly the shops actually are equipped. Information was gathered in from 62 properties in all parts of the country and of all sizes, the aim having been to include data from 25 companies in each of three classes: Class I, 5 to 50 cars; Class II, 100 to 300 cars, and Class III, 400 cars up. These data are summarized in the accompanying tables. With the actual data covering the 62 properties of all three classes as the basis, the total figures for the industry were roughly estimated.

The tables are self-explanatory so far as the data there are concerned. But it is by noting the blank spaces and the smallness of the figures opposite the items for some of the companies that one is able to discern to what extent the companies are equipped as to machine tools. The vertical columns show what the individual companies have and what they lack; the horizontal rows give a comparison among the several companies as to the extent of use of each type of machine tool equipment.

These first three tables do not take into account the suitability of the tools shown to be in use. A better idea of this is obtained by noting how long ago the present machines were manufactured. From the data collected from the 62 railways the date of manufacture is known for about 1,000 of the machines. Of these, but 14.2 per cent were purchased since 1920; 14 per cent are from 5 to 10 years old; 20.5 per cent are from 10 to 15 years old; 22.3 per cent are from 20 to 25 years old, and 18 per cent are more than 25 years old.

Some would claim that a machine tool that is more than 10 years old cannot be considered as of modern design. On that basis it might be said that more than two-thirds of the present machine tool equipment in electric railway shops could be replaced to the advantage of the railways.

The data collected also included a statement from the master mechanics as to tools that should be added to their present equipment in order that their maintenance work could be done efficiently. Thirty railways showed that they needed 191 new machine tools, as

Table I—Classification of Machine and Woodworking Tools in Seventeen Electric Railway Shops Maintaining from Twelve to Fifty Passenger Cars

Number passenger cars	12	16	16	22	24	25	26	37	39	42	43	44	46	47	50	50	50
Machine Shop																	
Emery wheel	1	1	1	1	2	1	1	1	2	2	1	2	1	1	3	2	3
Grinding machine	..	1	..	..	..	1	..	1	..	..	1	..	..	..	..	..	1
Grindstone	1	1	1	1	1	..	..	1	1	1	..	..	1	1	1	1	1
Drill press	1	1	1	1	3	2	..	..	2	2	1	2	1	1	2	4	3
Radial drill	..	..	..	..	..	..	1	..	..	..	..	..	..	..	1	..	..
Wheel turning lathe	..	..	..	N	1	1	N	N	..	1	..	..	..	1	1	1	1
Heavy turret lathe	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2
Low swing axle lathe	..	..	..	..	..	..	..	N	..	1	..	..	..	..	1	..	1
Other lathes	1	1	2	1	2	2	1	1	2	1	4	2	3	1	3	4	3
Milling machine	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..
Shaper	N	1	..	1	1	1	1	..	1	1	1	1	1	1	1	1	2
Power hack saw	1	1	1	N	1	1	1	..	1	1	1	1	1	1	1	1	1
Planer	..	..	1	..	1	1	..	..	N	..	1	..	..	..	..	..	1
Punch press	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1
Heavy duty punch and shear	..	..	..	..	N	..	..	..	..	1	..	..	..	..	..	..	..
Horizontal boring mill	..	..	..	..	..	..	..	..	..	1	..	..	..	..	1	..	..
Vertical boring mill	..	..	..	..	1	..	N	N	..	..	1	..	..	..	1	..	..
Wheel press	1	..	1	N	1	..	N	N	1	1	1	1	1	..	1	1	1
Pipe cut. and thread. mach.	..	..	..	N	1	..	..	N	1	1	..	..	..	..	..	..	..
Axle straightener	..	..	..	..	..	..	..	N	..	N	1	..	..	..	..	..	1
Bolt cutter	..	..	..	..	..	1	1	N	..	1	1	2	1	N	1	1	1
Key seat cutter	..	..	..	..	..	..	..	N	..	..	..	..	..	..	..	..	..
Woodworking Shop																	
Band saw	1	..	..	..	1	1	1	..	1	1	1	..	1	1	1	1	1
Universal table saw	..	..	..	..	1	N	1	..	..	..	..	..	N	..	1	1	1
Wood planer	..	..	..	..	1	1	1	..	..	1	1	..	N	1	1	1	1
Double spindle planer	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1	..	..
Wood lathe	..	..	..	..	1	..	1	..	..	1	..	..	..	..	1	1	..
Vertical mortiser	..	..	..	..	N	..	..	..	N	1	..	..	N	..	1	1	..
Horizontal mortiser	..	..	..	..	..	..	..	..	..	1	1	..	..	..	1	..	..
Rip and cut-off saws	..	..	1	..	..	1	..	..	1	1	1	..	..	1	2	1	..
Resaw	..	..	..	..	..	..	..	..	..	..	..	..	N	..	..	..	..
Shaper	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1	1	..
Power sander	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1	..	..
Joiner	..	..	..	..	N	..	..	..	1	..	..	..	..	..	1	1	1
Sticker	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..
Tenoner	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..
Saw filer and setter	..	..	..	..	..	..	..	..	..	1	1	..	..	..	1	..	1
Molding machine	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..
Glass cutting machine	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..

Note: N means additional tools needed to do maintenance work efficiently, as indicated by master mechanics.

Table II—Classification of Machine and Woodworking Tools in Twenty Electric Railway Shops Maintaining from 114 to 277 Passenger Cars

No. passenger cars	114	123	126	126	132	137	140	146	146	150	175	182	189	191	218	218	230	232	276	277
Machine Shop																				
Emery wheels	2	2	2	2	2	2	2	2	2	4	2	4	1	2	2	2	8	2	3	1
Grinding machine	..	..	..	..	..	..	..	..	..	1	1	1	..	..	1	..	..	..	1	..
Grindstone	1	..	1	1	..	1	..	1	1	..	2	..	..	1	..	..	3	1	..	1
Drill press	3	1	1	3	3	2	2	3	3	3	4	3	2	3	2	2	4	2	3	4
Radial drill	..	1	1	..	N	1	1	..	..	..	1	..	1	..	..	N	..	..	1	..
Wheel turning lathe	N	..	1	..	1	..	1	1	..	..	2	1	1	..	1	1	..	..	1	..
Heavy turret lathe	1	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	3	..
Hand screw machine	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..
Low swing axle lathe	..	..	..	1	1	..	..	1	..	2	1	1	..	..	N	..	1	..	..	..
Other lathes	2	2	2	2	4	4	3	3	2	1	4	2	3	7	3	3	2	3	5	2
Milling machine	N	..	1	..	N	..	..	..	N	..	..	1	..	..	..	N	1	..	2	..
Shaper	1	1	1	1	1	1	1	1	..	1	2	1	1	1	1	1	1	1	1	1
Power back saw	1	..	1	1	2	1	N	2	1	1	2	1	1	1	1	1	1	2	1	1
Planer	..	..	..	..	..	1	..	1	..	1	1	..	..	..	..	1	1	..	1	..
Punch press	..	..	..	..	N	..	..	..	..	..	1	..	..	..	N	..	..	..	1	..
Heavy duty punch and shears	..	..	..	..	..	1	..	..	..	..	..	1	N	..	..	..	..	..	..	1
Horizontal boring mill	..	1	..	..	..	..	1	1	..	..	..	1	..	..	..	1	1	..	..	..
Vertical boring mill	1	..	1	1	1	1	1	..	..	1	2	2	1	1	1	..	..	1	2	1
Wheel press	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Pipe cutting and threading machine	1	..	1	..	..	1	1	..	..	..	1	1	1	..	1	1	..	..	1	1
Axle straightener	1	..	N	..	1	..	..	..	..	1	1	1	..	1	..	..	1	..	..	1
Bolt cutter	1	1	1	N	1	..	..	..	1	..	1	1	..	1	1	..	..	1	1	1
Hydraulic press	..	..	..	..	..	1	..	..	..	..	..	..	..	..	1	..	1	1	..	..
Key seat cutter	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wheel grinder	1	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	1	..	..
Bearing boring machine	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Woodworking Shop																				
Band saw	1	1	1	1	1	1	1	1	1	1	..	1	..	1	1	1	1	1	1	1
Universal table saw	1	..	1	1	1	..	..	..	..	..	..	1	..	..	1	..	..	..	..	1
Wood planer	..	..	1	1	1	..	N	1	1	1	..	1	..	1	1	1	1	1	..	1
Double spindle planer	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	1
Wood lathe	..	1	1	1	1	1	1	1	1	..	..	1	..	..	1	1	..	..	..	1
Vertical mortiser	1	..	1	..	1	1	..	..	1	..	..	1	..	..	1	1	1	1	..	..
Horizontal mortiser	..	..	1	1	..	..	N	1	..	..	..	..	..	..	1	..	..	..	..	..
Swing saw	..	..	..	..	..	..	N	1	..	..	..	1	..	..	1	..	1	..	..	..
Rip and cut-off saws	..	1	1	1	..	1	1	1	1	1	..	..	..	1	1	1	1	1	1	2
Resaw	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..
Shaper	..	..	1	1	..	..	N	..	N	..	..	1	..	..	1	1	1	1	..	1
Power sander	..	..	..	1	..	..	N	..	1	..	..	2	..	..	1	..	2	..	..	2
Joiner	..	..	..	1	1	1	N	..	1	..	..	1	..	..	1	1	..	1	..	..
Sticker	..	1	..	..	..	..	N	..	..	..	..	..	..	..	1	..	..	..	..	..
Tenoner	..	..	1	1	..	..	..	..	..	..	..	1	..	1	1	..	..	..	..	1
Saw gummer	N	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..
Saw filer and setter	N	..	..	1	1	..	1	..	..	..	..	1	..	..	..	..	1	..	..	..
Universal wood worker	..	..	..	1	..	..	1	..	..	..	..	..	1	..	1	..	1	..	..	..
Molding machine	..	..	1	1	..	..	..	..	..	..	..	..	..	..	1	N	..	..	..	1
Post borer	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	N	..	..	..	..

Note: N means additional tools needed to do maintenance work efficiently, as indicated by master mechanics.

Table III—Classification of Machine and Woodworking Tools in Nineteen Electric Railway Shops Maintaining 400 Passenger Cars and Up

Number of passenger cars	400	407	409	410	416	438	445	500	600	629	653	738	755	807	1,030	1,398	1,466	1,500	2,343
Machine Shop																			
Emery wheels	5	2	3	3	2	1	4	4	6	1	2	5	5	2	7	10	1	9	2
Surface grinder	..	..	..	..	..	N	..	..	..	..	..	3	..	1	4	..	..	..	1
Grinding machine	1	2	1	..	1	..	N	1	3	..	1	2	3	2	3	5	3	4	1
Grindstone	..	1	1	1	2	1	..	..	..	..	..	1	..	1	..	2	1	1	2
Drill press	4	3	4	3	6	3	5	6	11	4	1	16	8	4	14	17	3	10	8
Radial drill	2	1	..	1	3	N	1	2	1	..	..	2	1	1	3	..	..	1	2
Wheel turning lathe	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	..	1	1	1
Heavy turret lathe	..	..	..	..	..	..	..	..	3	..	1	4	1	2	8	..	..	1	1
Hand screw machine	..	..	..	..	..	..	..	..	..	..	..	1	2	..	1	1	..	..	..
Low swing axle lathe	..	N	..	..	1	..	..	..	1	1	1	2	..	1	2	1	..	1	1
Other lathes	6	4	5	3	10	4	4	5	3	3	1	7	8	4	11	21	6	5	8
Milling machine	2	N	..	..	..	N	1	..	1	1	1	4	2	1	7	4	..	2	3
Shaper	2	1	1	1	2	2	2	2	2	2	1	5	3	1	1	3	1	2	2
Power back saw	..	1	2	1	..	1	1	3	1	1	1	5	2	2	2	1	2	1	1
Planer	1	1	1	1	2	1	1	3	3	..	1	3	3	1	5	4	1	1	1
Punch press	1	..	1	..	..	..	1	1	1	..	..	2	N	2	1	4	..	1	1
Heavy-duty punch and shears	..	..	..	..	1	..	..	..	..	..	..	2	..	1	..	..	..	1	1
Horizontal boring mill	1	1	..	..	..	..	..	..	..	1	..	..	1	1	2	1	..	1	2
Vertical boring mill	1	1	1	1	1	N	1	1	1	1	2	2	2	2	3	3	1	2	3
Wheel press	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2
Pipe cutting and threading machine	..	1	1	1	2	..	1	..	..	1	1	2	1	1	3	..	..	1	1
Axle straightener	1	1	..	1	1	1	1	1	..	..	..	1	1	1	1	1	1	..	2
Bolt cutter	1	1	..	1	2	1	..	2	1	..	..	3	..	2	2	3	1	1	1
Broaching press	1	N	..	..	..	N	..	..	..	..	..	..	..	..	2	1	..	..	1
Key seat cutter	..	N	..	..	..	..	..	..	..	..	..	1	1	..	1	1	..	..	..
Wheel grinder	..	..	..	..	..	..	1	1	..	..	..	..	1	1	..	2	..	..	..
Metal cutting saw	1	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	1	1
Hydraulic press	..	..	..	..	..	..	..	1	..	..	..	..	..	..	1	..	..	..	..
Gear cutters	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	1	..	..	..
Tapping machine	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	..	..	..
Woodworking Shop																			
Band saw	2	1	1	1	3	1	2	2	3	1	1	3	2	2	2	4	2	2	2
Universal table saw	..	1	..	1	1	N	1	..	1	1	..	1	1	2	1	1	1	3	1
Wood planer	1	1	1	2	1	..	1	1	2	1	1	3	1	3	2	2	..	..	1
Double spindle planer	..	..	..	1	1	1	..	..	..	..	..	..	1	1	..	2	..	1	1
Wood lathe	2	1	1	1	1	1	1	1	1	..	1	3	2	1	2	2	3	1	1
Vertical mortiser	2	..	..	1	1	1	1	2	1	1	1	1	1	1	..	2	1	1	2
Horizontal mortiser	..	1	1	1	1	..	..	..	1	..	..	1	1	1	2	2	..	..	2
Jig saw	1	..	1	1	..	..	..	..	..	..	..	1	1	1	..	1	..	..	1
Swing saw	1	1	..	1	..	N	1	1	1	..	1	1	2	1	1	1	1	1	1
Rip and cut-off saws	1	1	2	1	3	1	N	2	..	..	..	2	3	3	5	5	..	..	3
Resaw	..	1	..	..	..	..	..	..	..	..	1	..	..	1	1	1	..	..	..
Shaper	1	1	2	1	1	N	1	1	1	1	1	1	1	1	1	5	1	1	2
Power sander	1	1	..	1	2	..	N	1	1	..	1	4	3	1	2	1	1	2	1
Joiner	1	1	1	1	2	2	1	1	2	1	..	2	2	1	4	2	1	1	2
Sticker	1	1	1	1	3	N	..	1	1	1	1	2	..	3	1	3	..	..	2
Tenoner	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	3
Saw gummer	..	..	..	1	3	..	..	..	..	..	..	1	1	1	..	1	..	..	..
Saw filer and setter	..	..	1	1	2	1	..	1	..	..	..	1	1	2	..	4	..	1	1
Universal wood worker	..	..	1	1	..	1	..	..	1	..	1	3	1	2	1	3	..	..	..
Power groover	..	..	..	1	..	..	..	..	..	..	..	1	..	..	..	2	..	1	..
Molding machine	..	1	..	1	..	..	..	1	2	1	..	2	1	..	1	1	1	1	1
Dovetail machine	..	..	..	..	..	..	..	..	..	..	..	1	..	..	1	..	..	1	..
Knife grinder	..	1	..	1	..	..	..	..	..	..	..	..	2	..	1	..	..	..	..
Post borer	..	..	1	..	1	..	1	1	..	..	..	1	1	..	..	..	..	3	1

Note: N means additional tools needed to do maintenance work efficiently, as indicated by master mechanics.

listed in Table IV. The other 32 railways included in the study did not indicate the need of any additional tools. Assuming then that 191 is the total of additional machine tools needed by the 62 railways, it is estimated on this basis that the entire industry, if canvassed, would indicate its need for 2,500 additional new machine tools.

The 62 companies show a total of 1,893 machine tools of all types in their present shop equipment. This would indicate a total of approximately 25,000 machine tools in use in the electric railway field.

Of the total of 191 new machines shown to be needed by 30 companies 83 were for the machine shop, 55 for the carpenter shops, 23 for the forge shop, 15 for the armature room and 15 for the sheet metal shops. In the machine shops, particular need was expressed for additional surface grinders, wheel-turning lathes and other lathes, milling machines, axle straighteners and bolt cutters. In the woodworking shops the greatest need appears to be for universal table saws, wood shapers and power sanders. In the forge shops, bulldozers and shears are needed most. Armature rooms need banding lathes and the sheet metal shops need additional power shears.

Table IV—Additional Tools Needed by 30 Electric Railways to Carry On Maintenance Work More Efficiently

Machine Shop	
Emery Wheels	2
Surface Grinder	6
Grinding Machine	2
Grindstone	1
Drill Press	2
Radial Drill	4
Wheel Turning Lathe	7
Heavy Turret Lathe	2
Low Swing Axle Lathe	4
Other Lathes	5
Milling Machine	6
Shaper	2
Power Hack Saw	3
Planer	2
Punch Press	2
Punch and Shears	4
Vertical Boring Mill	4
Wheel Press	4
Pipe Cut. and Thread. Mach.	3
Axle Straightener	5
Bolt Cutter	5
Broaching Press	3
Key Seat Cutter	2
Air Hoist	1
Electric Welder	1
Babbitt Furnace	1
Total	83
Woodworking Shop	
Band Saw	1
Universal Table Saw	6
Wood Planer	4
Double Spindle Planer	2
Wood Lathe	1
Vertical Mortiser	4
Horizontal Mortiser	2
Jig Saw	1
Swing Saw	3
Rip Saw	3
Shaper	5
Power Sander	6
Joiner	2
Sticker	4
Tenoner	2
Saw Gummer	3
Saw Filer and Setter	3
Molding Machine	1
Boring Machine	1
Tool Grinder	1
Total	55
Forge Shop	
Forging Machine	1
Bulldozer	6
Steam Hammer	3
Air Hammer	3
Drop Forge Hammer	3
Punch and Shears	6
Belt Driven Hammer	1
Total	23
Armature Room	
Commutator Grooving Machine	2
Banding Lathe	6
Coil Winding Machines	2
Coil Presses	1
Commutator Lathe	1
Hydraulic Press	3
Total	15
Sheet Metal Shop	
Circle Cutter	2
Turning Machine	1
Setting Down Machine	1
Foot Power Shears	5
Foot Power Punch	1
Foot or Hand Break	2
Scroll Shears	1
Riveting Machine	2
Total	15

A by-product of Tables I, II and III is that they enable one to see just about what machines ought to be included in the equipment of electric railway shops of various sizes.

Big Track Job Quickly Done

THE rapidity with which trackwork can be done when a full equipment of plows, concrete breakers, etc., is used was shown by a job done by the Cleveland Railway. This job consisted in taking out and relaying 669 ft. of double track on East Ninth Street, between Euclid Avenue and Prospect Avenue, S.E. Approximately thirty-four and one-half working hours were consumed. Two shifts of sixty men each began work at 9 o'clock on a Saturday evening, and worked constantly until 5 o'clock on the following Monday morning when the first car operated over the new rail.

After taking up the pavement and removing the old tracks, a new double track, using 102-lb. rail, was laid, riveted and welded, and 4 in. of concrete poured over the International steel ties. During the progress of this work vehicular traffic, bound north and south at Cleveland's busiest corner, was not interrupted.

Acid in Lubricating Oil Advocated to Reduce Friction

THAT the addition of small quantities of organic acids to mineral lubricating oil reduces the friction in bearings was asserted by Dr. T. E. Stanton, director of the National Physical Laboratory, England, in a lecture before the last meeting of the International Air Congress in London. He took issue with the Reynolds theory of lubrication, which assumes that the value of oils as lubricants depends solely on their viscosity, and that the nature and composition of the rubbing surfaces have nothing to do with the efficiency of the bearing.

"Up to comparatively recently," said Dr. Stanton, "it has been common to state that the Reynolds theory is not concerned with the manner in which the film of oil is formed, but only with the conditions which exist when it is formed, and that it may well happen that when starting up machines from rest when the bearing surfaces are in contact, certain special characteristics of lubricants on bearing surfaces may be essential not only to prevent excessive wear; but to insure conditions favorable to the formation of a separating film.

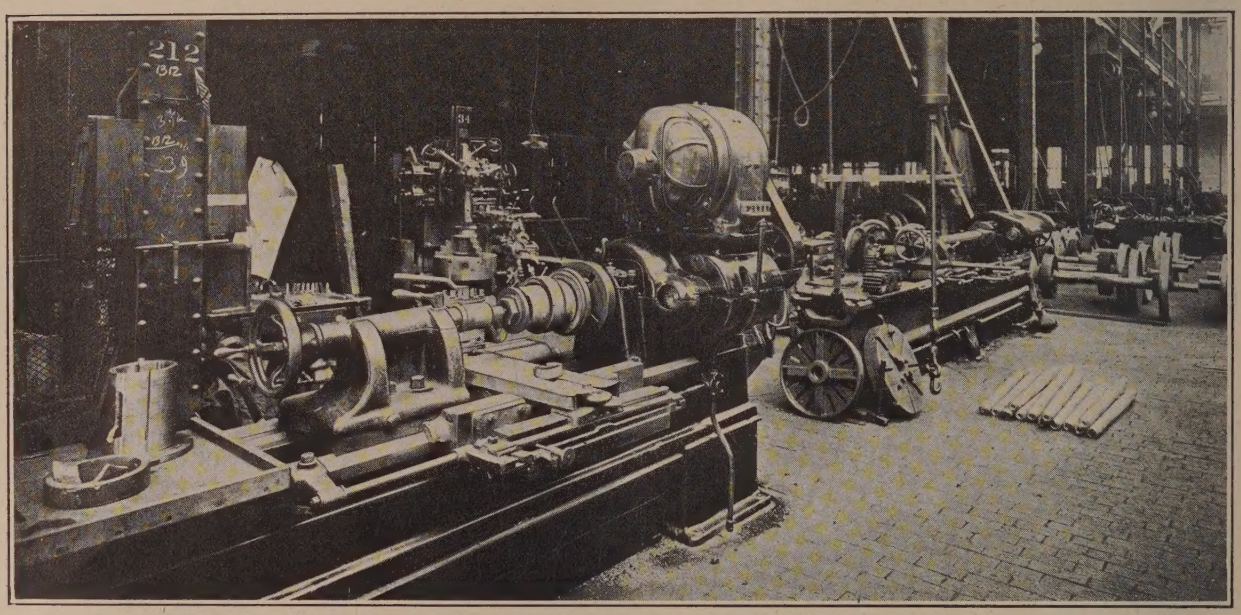
"Gradually, however, it has become more and more certain that there can exist between rubbing surfaces a condition of steady lubrication whose characteristics are totally different from those to be expected from the application of the Reynolds theory. It is now recognized that solid surfaces having an adsorbed layer of lubricant of only one molecule in thickness can slide over each other with comparatively small frictional resistance. Further, it is known that adsorption is dependent upon the chemical constitution of the lubricant and that the greater the work done in the process of adsorption the less the frictional resistance on the surface to sliding. Acids, alcohol, and esters are more strongly adsorbed by water than are paraffins, and it is found that the former are the better lubricants."

Dr. Stanton then described a series of tests made on various types of bearings and gears, which indicated a marked superiority of the animal and vegetable oils over the mineral oils as regards the temperature at which the gears could be run without a serious increase in the friction. Tests were made with various kinds of animal, vegetable and mineral oils, including a petroleum product known as "Bayonne oil." The following observation was made:

"The effect was then tried of adding small percentages of organic acid to the Bayonne oil in order to find out whether any reduction of friction took place corresponding to that obtained in the worm-gear test previously carried out by the Lubricant and Lubrication Inquiry Committee. It was found that a 17 per cent reduction in the coefficient of friction was obtained by the addition of as little as 1 per cent of organic acid to the Bayonne oil, and that increasing the amount up to 5 per cent did not effect any further improvement."

How Modern Machine Tools Cut Costs

Multiple-Cut, Low-Swing Lathes Reduce Time for Machining Axles to One-Quarter of that Required with Older Type Machines—Finishing Axle Surfaces by Grinding Reduces Time by 25 per Cent—New Type Boring Mill Turns Out Twice as Many Wheels per Day as the Average in Most Shops



Three Tools Used in Machining Bearings and Axles in Vincennes Shops of Chicago Surface Lines

IN A special search for new and particularly effective methods of applying modern machine tools to the maintenance work in electric railway shops, the editors of the JOURNAL have visited some fifty properties and have found a few examples that are described here. These have been selected from the practices found in the fifty shops because they showed a real effort to apply modern machine tools and methods to electric railway work. Some of the practices given show the application of new machine tools, while others describe new uses of old machine tools.

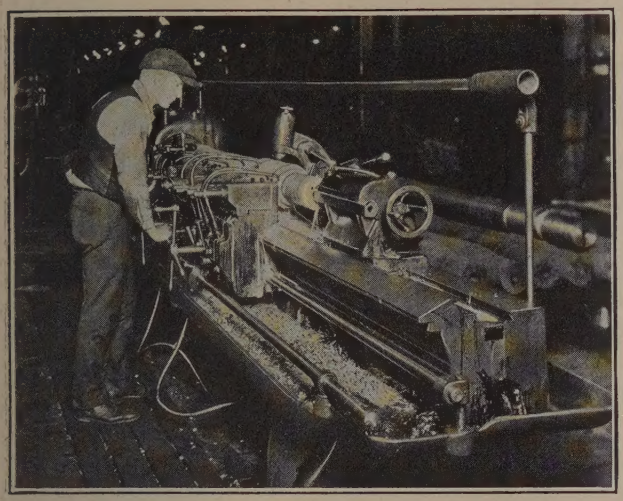
The use of modern machine tools has a direct bearing on the cost of labor and produces a further saving by reducing the time that cars must be held in the shop for repairs. There are certain classes of maintenance work that must be handled continually, and as a result the same kind of machine work is done repeatedly. In such cases the volume of this work may be sufficient so that a modern machine tool, particularly adapted for this single class of work, will prove a paying investment and make it possible to apply manufacturing methods to maintenance work with gratifying economies and production of better work.

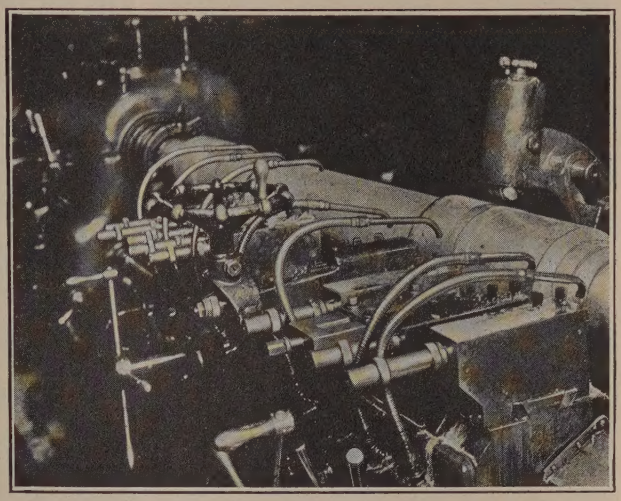
The real function of an electric railway shop is to get the equipment back into service after repairs in the shortest space of time and with the lowest possible cost. The variety of work handled is necessarily very great, and it is not always practical to have the best machine with which to do each class of work. In talking with various shop foremen and master mechanics, however, the editors have been impressed with the fact that they are quite awake to the losses their companies are suffering because of the continued use of old machine tools, when new tools with far greater production capacity are available. The cost of new tools is quite an item, however, and many managements have not been willing to put any additional investment into the shop. Now, with widely improving financial conditions among the railways, more interest in shop economies through purchase of new machines is beginning to be evidenced.

By considering the various kinds and quantities of work done in maintaining electric equipment, such as the turning of wheels, machining of axles, finishing of bearings and building up and remachining of motor shell fits, one finds jobs that are done repeatedly, and in considerable quantities, by all railway shops. On the larger electric railway systems the quantity of each of these various classes of work is sufficient to keep certain machine tools in continuous operation on one class of work. These shops can therefore afford to have a machine particularly adapted for the individual work to be performed.

How Multiple Cutting Lathes Reduce Cost of Axle Machining

The amount of axle work done by various roads is considerable. In shops of the larger systems several lathes are kept busy continuously turning axles, and in most of the smaller shops this machine work constitutes a considerable proportion of the lathe work. Most railways purchase their axles from rough stock and finish them to the required dimensions. In addition, of course, there is considerable machine work required in refin-



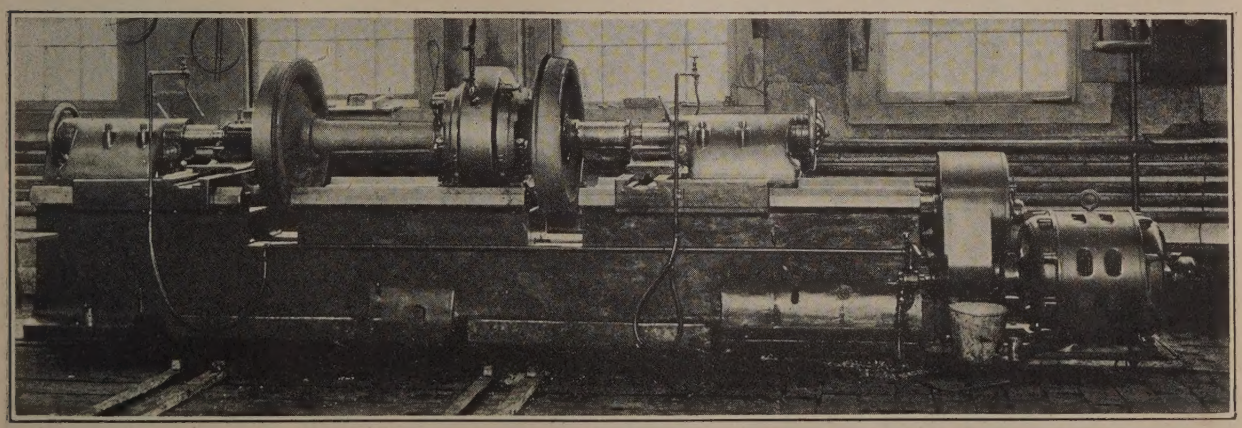


Machining a Large Subway Axle in a Lathe with Two Carriages and Six Tool Posts at One of the Shops of the Brooklyn-Manhattan Transit Corporation. The Illustration at the Right Shows Arrangement of Tools so that Six Surfaces on the Axle Are Finished at the Same Time

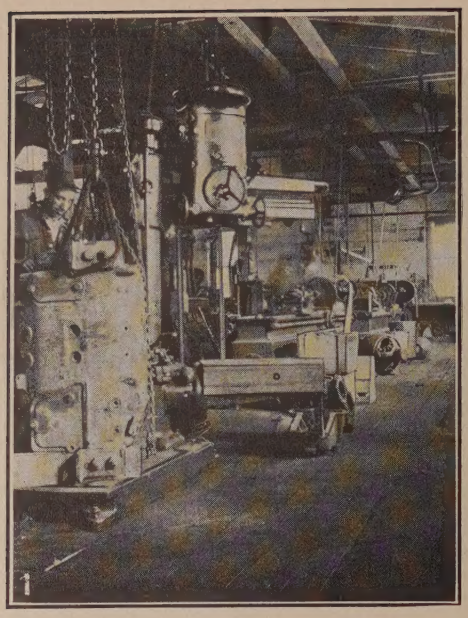
ishing worn axles. Axles for electric railway service have several shoulders and machined fits of various diameters, the finished part usually consisting of two journal fits, two machined surfaces for dust collars, two wheel fits, one gear fit and two axle bearing fits. In addition it is frequently necessary to rough turn the center part of the axle. There are thus nine finished fits of varying diameters and lengths. Where the amount of axle work is great enough a particular machine can be set aside for doing this. A lathe with 8-in. swing is sufficient since the finished diameters of axles are rarely more than 7 in.

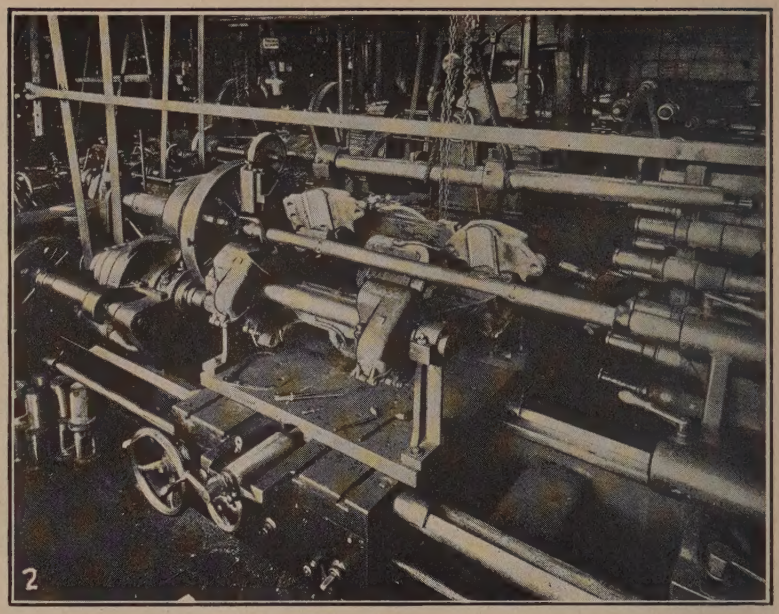
The Brooklyn-Manhattan Transit Corporation, which maintains nearly 6,000 elevated, subway and surface cars in Brooklyn, New York, has recently purchased two Lo-Swing lathes from the Fitchburg Machine Works to be used exclusively for axle work. These lathes have an 8-in. swing and 108-in. length of bed. They are provided with two carriages with three tool posts on each, so that six tools can be used for cutting on the same piece at the same time. As a result of the use of this rapid production lathe, the time necessary to finish axles has been reduced to one-fourth of what it was originally, where ordinary low-swing engine lathes were used. An accompanying illustration shows one of these lathes in operation while turning a large subway car axle. The various finished fits for this type of axle are journals 5 x 9 in., dust guard surfaces $6\frac{1}{8}$ in. x 2 in., wheel fits $7\frac{7}{16}$ in. x $6\frac{1}{2}$ in., gear seats $7\frac{1}{2}$ in. x $6\frac{1}{8}$ in. and axle bearings $6\frac{1}{2}$ in. x $12\frac{3}{4}$ in. The total length of the axle is 7 ft. 1 in. The illustrations show this machine in operation just as the rough cuts at one end of the axle are being finished.

With the improved lathe equipment this size axle is now being turned for file finish and rolling of bearing fits in an average of two and one-half hours. With the lathes previously used the machining of this size axle required three hours for rough finishing and an additional nine hours for finishing cuts. In addition to provision for multiple-tools cutting simultaneously this type of lathe has a geared headstock, providing for six spindle speeds, and a geared feed with nine changes. The geared headstock is of rugged design, so as to withstand the severe strain imposed upon it when several tools are taking heavy cuts simultaneously. The clutch for starting and stopping the machine is on the driving pulley shaft and is operated by the shifter rod placed above the table. In order to give a rigid support to the tool holders, these are clamped directly to the carriage casting itself, which in turn bears directly on the bed of the lathe. This eliminates numerous intervening parts in the supports for the cutting tools



Lathe with Two Carriages and Machined Gaps in the Bed, Turning Journals of Axles with Wheels Mounted



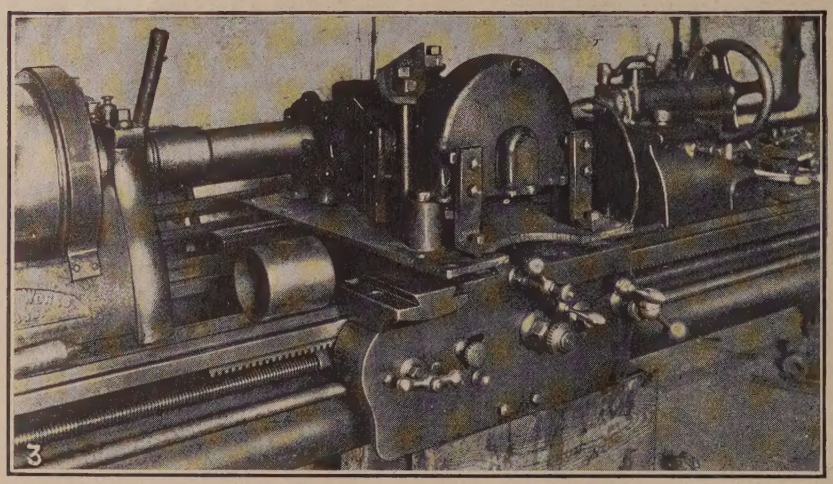


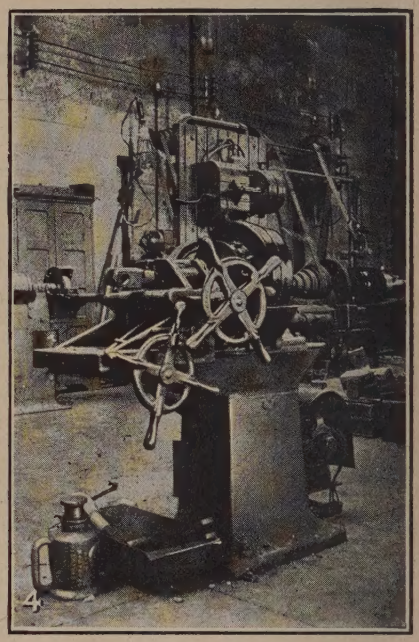
No. 1. Boring out a motor shell in the shops of the Washington Railway & Electric Company by use of a radial drill.

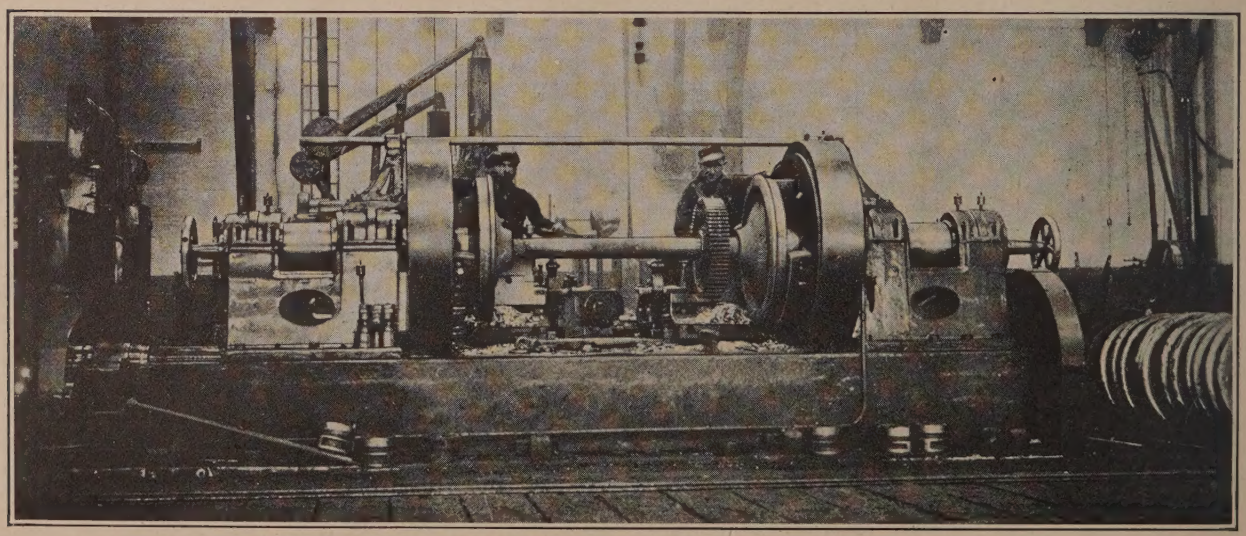
No. 2. Double-spindle lathe used for boring out motor shells at Spokane, Wash.

No. 3. Reboring compressor cylinders with boring bar attachment to lathe.

No. 4. A combination bolt and pipe threading machine is a great time saver in electric railway shops.







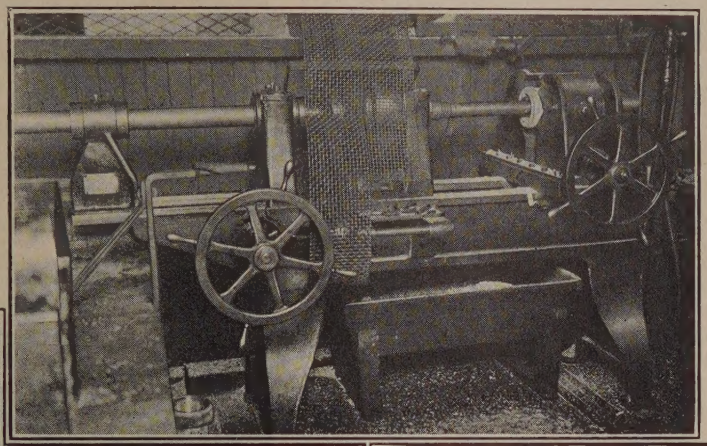
Modern Type of Niles Wheel Lathe in the Shops of the United Railways & Electric Company, Baltimore

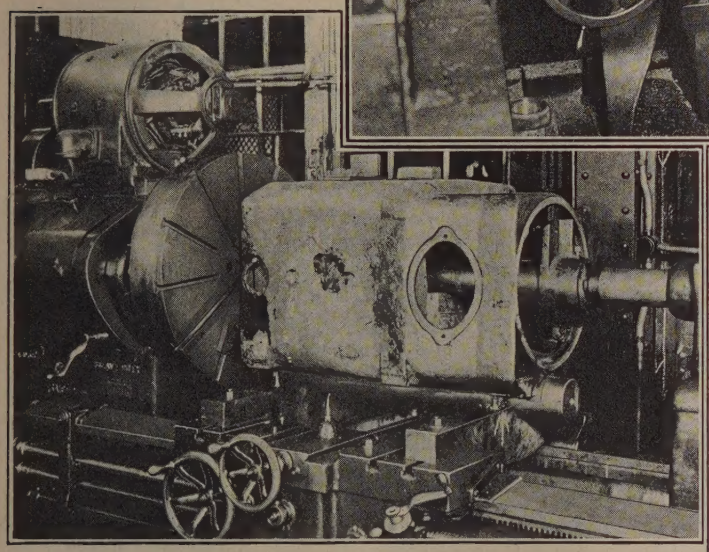
and avoids possibilities for vibration. The cutting tools do not extend across the bed of the lathe. This permits the carriage to be run past the tailstock, or back rest, without moving the tools from their positions. A geared pump is built into the head of the lathe for providing a continuous flow of cutting compound.

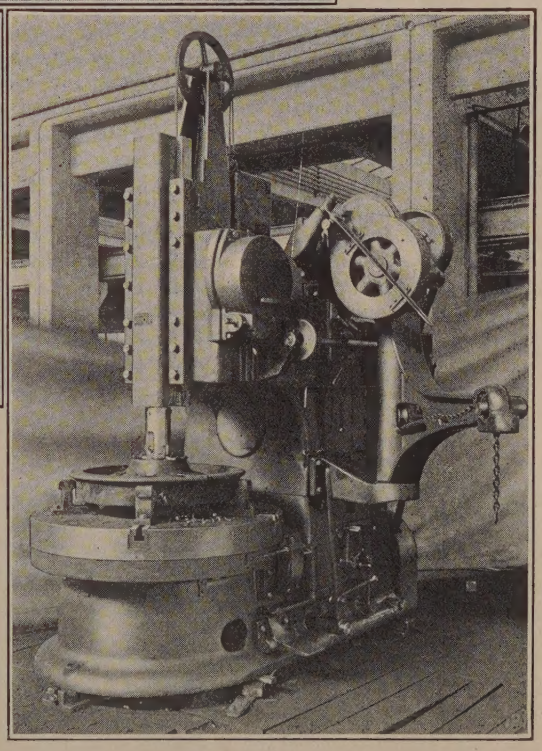
A modern multiple-cut, low-swing lathe is also used in the West Shops of the Chicago Surface Lines for machining armature shafts. This machine takes six simultaneous cuts on different sized shoulders and compared with the single tool method commonly used has almost three times the output.

After the machine work on axles is done in a lathe it is the usual practice in electric railway shops to file finish, burnish with rollers or to grind the finished surfaces of the various fits. An accurate smooth surface is most essential for this work, since if the bearing surfaces are rough the linings of bearings are ground out quickly and additional maintenance repairs to the bearings are soon needed. Various methods for file finishing and burnishing with rollers have been described frequently in the columns of this paper. Surface grinding for finishing the bearing faces is coming into more extensive use. An accompanying illustration shows an armature shaft being finished by grinding in the shop of the Chicago Surface Lines. The grinding machine used in this case saves 25 per cent of the time that was taken previously when axles were finished in a lathe. It is also claimed that there is greater accuracy of dimensions and smoothness of finish so that longer life of bearings results. Where wheels or gears are to be pressed on axles the grinding finish produces more uniform pressure for pressing on and a better fit on the shaft, as irregularities are eliminated. In the Chicago shop the entire shaft is finished on a grinder.

A few roads which have used the grinding methods called particular attention to the necessity of removing all emery from the surface, since if emery particles are left on the bearing faces there is a tendency for this to grind out the bearings themselves and so reduce their life. As the pressure employed, however, is not great, there is very little danger of the particles of emery becoming imbedded in the surface of the axle. The maintenance of journals requires returning bearing fits due to their becoming scored, cut or excessively worn, and unless the wheels are worn out so that their removal and replacement is necessary, it is often more convenient and economical to turn the journals with the wheels mounted on the axle. This method greatly increases the production as compared to that obtained when the wheels are pressed off the axle, the journals re-turned in an axle lathe, and the wheels again pressed on. There is also the difficulty and loss of time in this latter method of having to match the wheels and axles; also, when once the original tight fit between the wheels and axles is destroyed, a lower





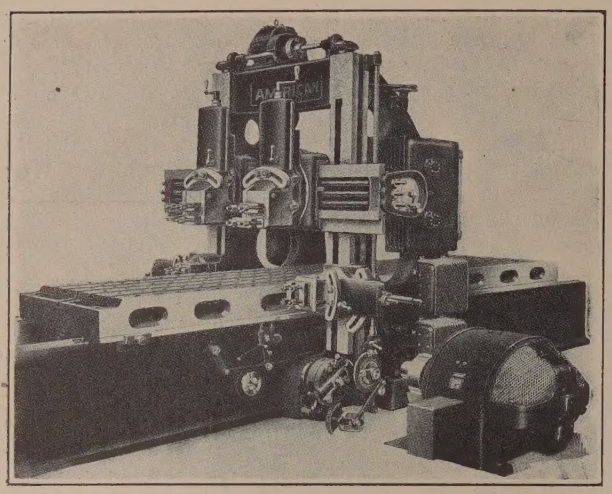


Three Rapid Production Machine Tools that Obtain Marked Economies

Top—Universal jaw-type chuck used on machines for boring bearings in the Eastern Division shops of the Brooklyn-Manhattan Transit Corporation.

Left—Machining the armature housing fit in a motor shell in the Chicago Rapid Transit Company's shops.

Right—Car wheel borer with capacity of from ten to fifteen wheels per hour.



Multiple Tool Planer Suitable for Electric Railway Machine Shop Operation

pressure will force the wheels in position with newly machined axles and wheels, and the fit will be looser.

For this class of work several railways are considering the use of a combination journal truing and axle lathe, as manufactured by the Consolidated Machine Tool Corporation, Rochester, N. Y., and shown in an accompanying illustration. This machine has a headstock of the opening type located in the center of the lathe and the bed has machined gaps for swinging wheels up to 45 in. in diameter. When used as a journal truing machine the two carriages turn the journals at the same time with the wheels mounted. Finished filler blocks are furnished which, when inserted in the machined gap, give the carriage full travel between the driving head and the end of the machine, so that regular axle turning can be taken care of economically.

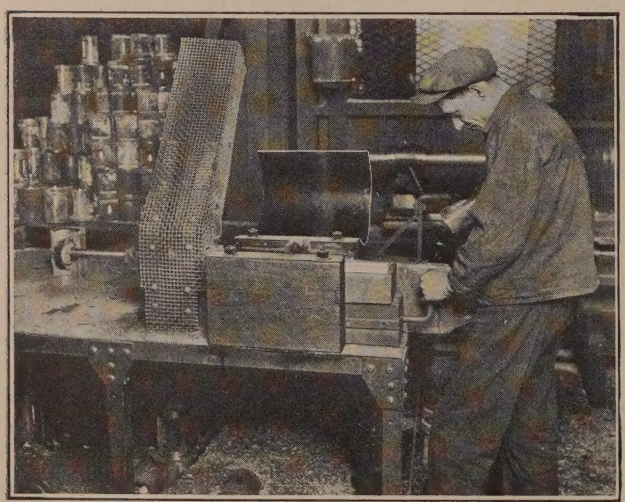
These lathes have a 27-in. swing over the bed, so that they will accommodate an axle with the gear mounted. In work which requires the re-truing of journals some users of this type of lathe are obtaining an average production of two sets of axles per hour; i.e., re-truing four journals. This, of course, exceeds the production that can be obtained where it is necessary to press wheels off and on again in order to turn the journals.

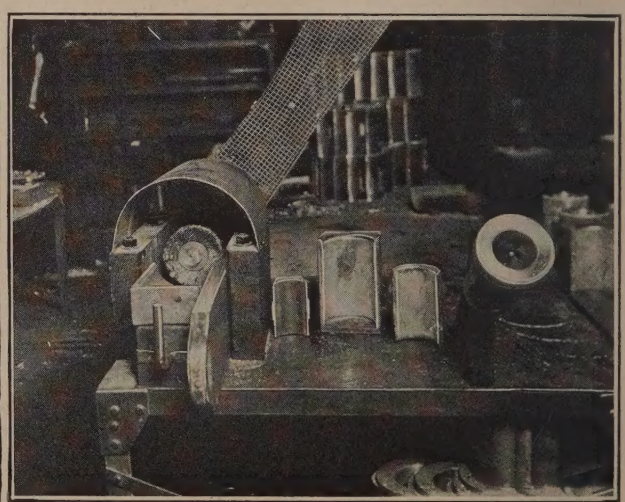
In the survey of machine tool equipment which has been made a considerable number of double-spindle lathes were found in use in electric railway shops. These double-purpose machines provide swings of either 24 in. or 48 in. in most cases. It is possible by using the high spindle to turn journal bearings in this type of lathe with the wheels and gears mounted. Some of the smaller railways which do not possess a wheel-turning lathe are using the two-spindle type for turning their wheels. While using the high spindle, but one wheel can be turned at a time and the cutting speed is quite slow, so that the average production is usually not more than two pairs of wheels per day. The changing from one spindle to the other takes considerable time, too, and entails a considerable amount of labor, so that most foremen do not favor the use of a double-purpose lathe where it is possible to purchase two single-purpose tools.

Improvements in Wheel Lathes and Boring Mills

The machine tool equipment required for wheel work was quite thoroughly treated in a series of articles on "Wheel, Gear and Axle Practice" which was published in the issues of this paper for Aug. 18, Oct. 27 and Nov. 17, 1923. Properties having steel wheels require an efficient wheel-turning lathe. The size of this is determined, of course, primarily by the size of the wheels which it is necessary to turn; probably either the 36-in. or the 42-in. size are in most general use. Several improvements have been made recently in wheel-turning lathes, particularly in regard to the shifting arrangement to save time in getting the wheels into position and also in the lathe equipment to permit taking heavier cuts with more rapid feed than with the old machines. These improvements of course speed up production and are of particular advantage.

A wheel press is necessary in almost every shop, and where steel wheels are used most properties favor a size of at least 400 tons capacity. At present a majority of the railways are using smaller presses, particularly the 300-ton size. But many have found difficulty in starting wheels when pressing off, and also in pressing off gears. Thus, with the smaller sizes of presses it is necessary to heat the wheels in order to start them, while with the 400-ton size a large number of these will start without the necessity of heating.





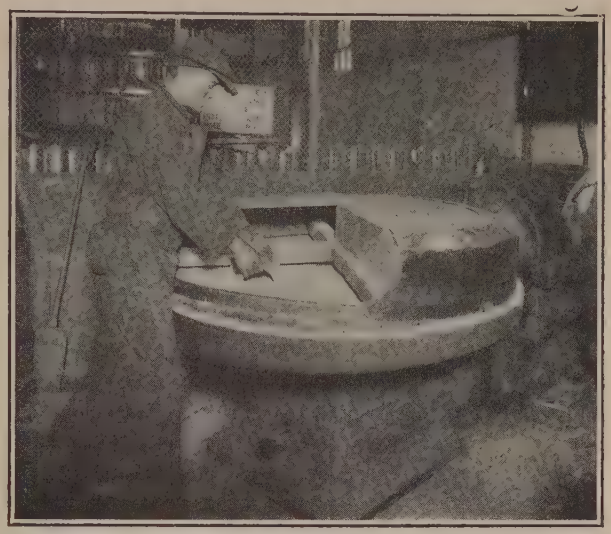
Left—Removing Excess Babbitt from Bearings with Circular Wire Brushes. Right—End View of Machine Shows the Brush and the Wedge Inserted to Remove Babbitt from Edge of Bearing

This of course saves considerable time and reduces the cost of the work considerably.

A boring mill is another piece of equipment which is necessary for wheel and gear work. The 36-in. or 42-in. sizes are most commonly used by electric railways. Modern boring mills have several new features that have been introduced within the past two or three years. One type just being introduced by the Consolidated Machine Tool Corporation of Rochester, N. Y., has an automatic chuck and independent power-driven rapid traverse to both the boring and facing spindles. This reduces the amount of labor and time required. The automatic chuck is controlled by a reversing friction clutch, so that it is unnecessary to stop or reverse the motor when closing or opening the chuck. When the driving clutch is thrown in, the table starts to rotate and the jaws move toward the center, gripping the wheel with the full driving force of the motor, and the heavier the cut the tighter the jaws will grip. When the bore is finished the table is stopped by means of a band brake operated by a foot pedal and the clutch is then thrown to the reverse direction, causing the jaws to open. This band brake also serves for stopping the table and allowing the operator to caliper the bore of the wheel, without loosening the grip of the jaws.

Six feeds are provided, which are obtained through selective, sliding gears. These may be changed while the machine is running. When the roughing cutter has passed through the wheel the operator can throw the proper speed lever so as to throw in the finishing speed without stopping the lathe. Two-in-one boring tools can be used with advantage. This machine is also made with a horizontal tool head for facing off the hubs of wheels, where this is required. Users of this machine are boring from ten to fifteen wheels an hour, which is extremely rapid production and twice the average obtained by most electric railway shops.

Another machine tool used to advantage in wheel and axle work is an axle straightener. Many railways are using some of their ordinary lathes with a special rigging for straightening axles, but in general much time is lost through the use of such devices, and the work is not done as satisfactorily nor efficiently as having a proper machine adapted to axle straightening.

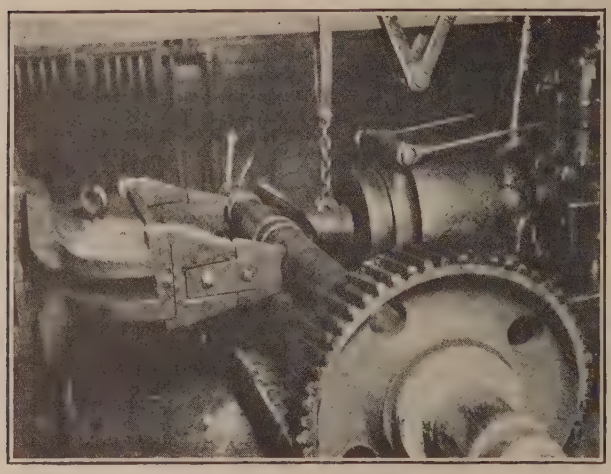


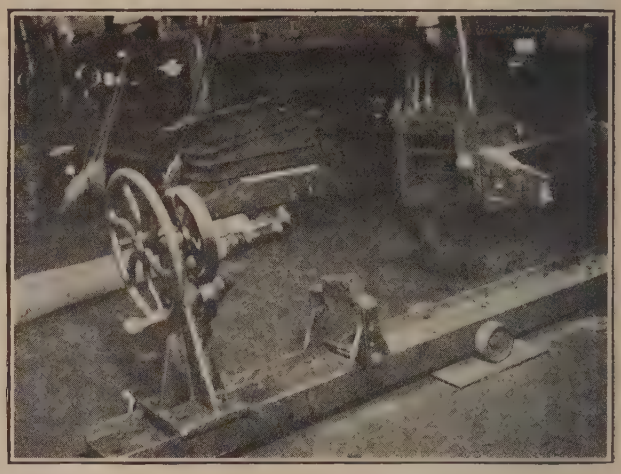
Finishing Axle Bearing Shells by Use of a Surface Grinder Multiplies Production by Four

Axles are straightened on a small wheel press in the shops of the Cleveland Railways. A fixture for holding the axle between centers is mounted on rollers so it can be moved transversely across the bed of the wheel press. The base of the fixture is a 12-in. I-beam. Upon this are mounted head and tail stocks, each equipped with a center. The head stock contains a hand wheel which drives a dog through a train of gears. This is used to revolve the axle and determine the position of the bend. Attachments to the head and tail stocks of the wheel press apply the pressure to the axle at the proper points for straightening. The advantage of this application lies in the large amount of power available from the 200-ton press.

The use of keys in connection with wheel and gear work is decreasing, but many railways have shops provided with key seaters. Where the work requires such a machine it should be arranged to cut key ways up to 1 in. in size, and preferably should be a single-purpose machine. On roads with few cars it is pos-

Left—Armature Shafts Are Finished in a Grinding Machine with a Saving of 25 per Cent in Time and (Right) Emery Wheels Are Set Aside for Tool Grinding in the Shops of the Chicago Surface Lines





Left—Straightening an Axle on a 200-Ton Wheel Press at Harvard Shops, Cleveland. Right—The Fixture Used for Holding the Axle Between Centers While Being Straightened

sible to use a slotter for this class of work, and as a slotter is a very handy tool to have in any machine shop the average size road will find such a tool preferable to a key seater, particularly where the amount of work is limited.

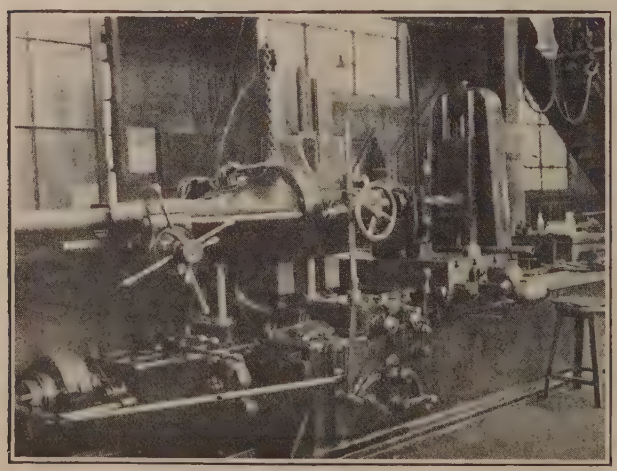
On the Pittsburgh Railways all key ways in armature shafts are cut with square bottom ends by means of a vertical head attachment to a universal milling machine. The machine used is a Milwaukee miller No. 1½, and when not in use for key ways is kept busy on other milling operations.

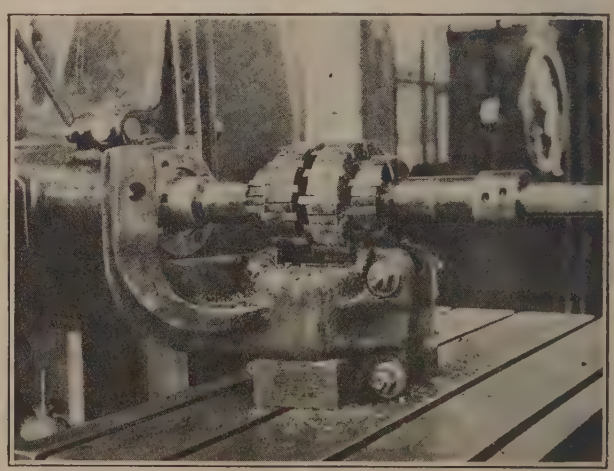
Efficient Methods of Machining Bearings

The machining of bearings is another important part of the work done by electric railway mchine shops. Some of the larger properties purchase the rough castings for bearings and machine the outside as well as the inside bearing surfaces. The majority of electric railways, however, buy their bearing shells machined on the outside and bore these out to fit the particular shaft to which they are to be applied. Bearings also constitute an item requiring a large amount of maintenance repairs. Probably the majority of bearings in use by electric railways are of a babbitted type, with either an iron or bronze shell. Solid bronze bearings are coming into more general use, particularly for armature and axle bearings. Bearing wear takes place not only on the inside bearing surface but also on the outside part that fits into the motor housing, and also on the end flanges. So while new bearings may require boring only, it is evident that the maintenance of bearings requires finishing of other parts as well.

The time consumed in machining a bearing is comparatively small, and it thus becomes of increasing importance to provide equipment so that the bearings can be chucked quickly and accurately. Otherwise, the time consumed in getting the bearing ready for the machining operation may take fully as long as the machining itself. This has resulted in a large number of special designs of bearing chucks being used; in fact, as one visits the various railway properties nearly every shop has its own particular design of bearing chucks, which some one has devised for facilitating this work. A large number of the various designs used have been described in the columns of this paper from time to time. Where various sizes and types of bearings are used the chucks usually consist of one master chuck and subordinate bushings to fit the various bearings.

The Pittsburgh Railways uses special centers for holding armature bearing shells while turning in a lathe. The shell is swung between two tapered centers. The live center is three-cornered and has a 60-deg. taper,





Left—Milling-Boring Machine in Harvard Shops, Cleveland. Right—Set-Up for Milling an Axle Bearing Cap on the Milling-Boring Machine

the three corners engaging grooves in the end of the shell. This serves as the drive. The dead center also has a 60-deg. taper and revolves. Mounted in this manner, it is possible to finish the entire outside length of the bearing shell, because there is no driving dog to interfere with the travel of the cutting tool. This method has reduced the time previously consumed for this operation by 25 per cent.

The Pittsburgh Railways also uses a special mandrel and clamp for turning split axle bearings on the outside. This holds the halves together and makes it possible to turn the halves as a unit on centers in the lathe. This job is completed in two-thirds of one man-hour. The former method of chucking the bearings in a four-jawed chuck and turning required one man-hour per set of two halves.

Axle bearing collars are bored on a drill press. This is accomplished by mounting the collar on a simple fixture or chucking device. The boring bar with the cutting bit is fed through the shells by the hand feed on the drill press. The time required for this operation, including the "set-up," is one-half man-hour per bearing collar. The former method of boring on an engine lathe required one and one-half man-hours.

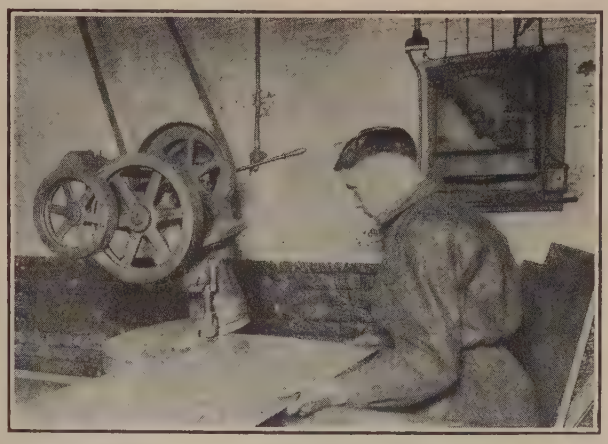
In Chicago a surface grinder is used for finishing the faces of axle bearing shells previous to sweating them together for turning. This method gives approximately four times the output per day which was formerly obtained by doing this job on a planer or shaper.

Some Special Machines Used in Bearing Work

Some electric railway shops have special bearing lathes and horizontal boring machines which have been purchased from machine tool manufacturers. An accompanying illustration shows a special boring machine used in several of the shops of the Brooklyn-Manhattan Transit Corporation for rough-boring bearings. These machines, of which the company has eight, were purchased from H. B. Underwood & Company and have tapered chucks for holding and centering the bearing and use a boring bar. This type of machine is very efficient, the chuck being arranged in two parts so that the jaws are separated or forced together by means of a screw with a hand wheel. The placing of a bearing in position for boring and its removal thus takes but a moment. The boring bar is provided with supports at either end, and the drive is through a pulley with bearings at the center of the lathe. The practice of the Brooklyn-Manhattan Transit Corporation is to rough-bore all bearings at one shop, but they are finish-bored at the maintenance shop, so as to fit the particular shaft to which they are to be applied. This company now purchases its bearings finished on the outside, so that the only machining operation is that of boring.

Railways which do the entire machine work on their bearings have frequent use for a turret lathe. Since the flanged portions of armature and axle bearings, as well as the outside and inside surfaces, require machining, several different tools are necessary. With the turret head, of course, the different tools can be placed in position and the various machining operations carried out without the necessity for rechucking the bearings. This saves time and labor and reduces the cost of the machine work.

A discussion of the various special tools and methods used in connection with babbitting and finishing babbitted bearings would take more space than is available

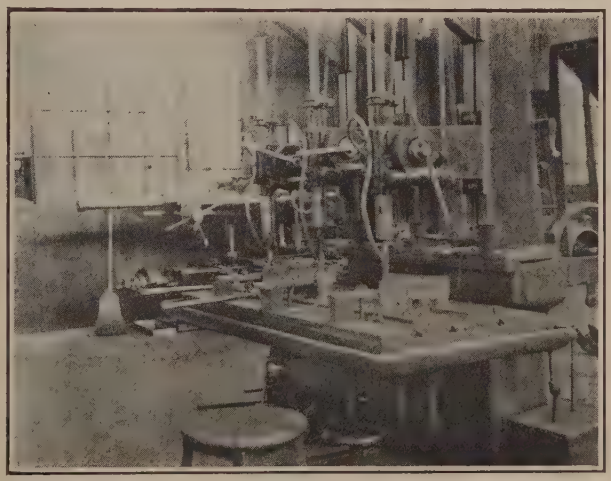


Serpentine Shear Handles Variety of Sheet Metals in C. S. L. Shop

in this article, but a special use of a standard buffing machine for removing excess babbitt shows a new use of an old-type machine which introduces a good economy.

An accompanying illustration shows a single-spindle machine, such as would be used for ordinary buffing work, belt-driven from the center and fitted with wire brushes instead of buffing wheels. This machine is used in the East New York repair shops of the Brooklyn-Manhattan Transit Corporation for removing the hard coating of babbitt, scale, dirt and oxide from axle and journal bearings immediately after the babbitting has been completed. By using wire brushes of the proper diameter all excess metal can be removed very rapidly. The boring operation, which is carried on afterward, is thus facilitated.

The operation of brushing out this material is performed by placing the bearings on a wooden block, which serves as a carriage. This wooden block has a handle at the end, so that the operator can force the bearings underneath the rotating wire brush to remove the babbitt. This method is also used for opening up the side clearance to provide space for the lubricating oil to enter when the bearing is in service. In this latter case, instead of the bearing being moved in central with the rotating brush, it is forced to one side by the use of a spacing board. The babbitt is thus removed from



Drilling Brake Shoe Heads on a Three-Spindle Drill Press in Harvard Shops, Cleveland

the side of the bearings, as would ordinarily be done by scraping, and the time necessary for finishing the bearing is cut to about one-tenth of what it would be by the old process.

This machine can also be used for the repair of worn bearings, where the useful life of the babbitt metal has not been entirely reached. In service, bearings wear on the crown and the metal is pushed to the side. Where bearings are removed and are again to be returned to service without rebabbitting the wire brush method is of particular advantage in opening up clearance at the side, instead of by scraping. The wire brushes also have an advantage in the quality of the

Drilling Holes in Brake Pins with Multiple-Spindle Horizontal Drill

finished surface, as it is much finer and without ridges, which sometimes occur when a bearing is scraped.

This machine constitutes a part of the equipment of the babbitt room and has a sheet iron hinged guard, which is closed down while the machine is being used so as to prevent any danger of flying particles injuring workmen.

Special Tools and Jigs Facilitate Reboring of Motor Shells

One of the most important tasks of the electric railway machine shop is the machining operation necessary to take up the wear in the axle and armature bearing housings of railway motors. Many railways build up housing fits by electric welding and then face off surfaces on a planer and rebore the housing fit either in a boring mill, a radial drill or a lathe. Probably the great variety of methods used in the various shops is due to the railways trying to adapt equipment which they already have to the needs of this work. A high standard of machine work is necessary for this maintenance, as many of the motor and bearing failures can be traced directly to poor standards of work or to poor fitting of the frame parts. A loose housing permits vibration of the armature, which in turn causes sparking at the commutator, loosening of the brushholders, insulation failures, burnouts, hot bearings, scored armature shafts and armature failures, the repair of which greatly exceeds the cost of doing this major machine work properly.

A very complete method of rehabilitating motors as carried out in the shops of the Kansas City Railways was described in the ELECTRIC RAILWAY JOURNAL for May 20, 1922. After building up the various worn surfaces by welding, the Kansas City practice includes the planing off of the motor frames on a planer, the boring out of the housing fits on a horizontal boring mill and the redrilling of various housing bolt holes on a radial drill. A large assortment of jigs and fixtures are necessary in order to insure accuracy of the work.

In the shops of the Chicago Rapid Transit Company motor shells are rebored in a large swing lathe by supporting the motor on a special jig laid across the lathe carriage. In one of the shops in Brooklyn an engine lathe is used for reboring motor shells by the addition of a geared shaft, so that four bearing fits are bored at one time. In another shop in Brooklyn the boring is done on a horizontal boring mill which has been changed from a one-spindle to a two-spindle unit. This also provides for the boring of the four housing fits at the same time.

In the shops of the Philadelphia Rapid Transit Company a job of reboring some G.E.-80 motor shells was done on a vertical boring machine by providing a jig which was fastened to the motor shell, so that the entire shell, together with the jig as a unit, could be handled by a crane and placed in position for the boring operation and be moved from one boring position to the next without danger of causing inaccuracy of the boring.

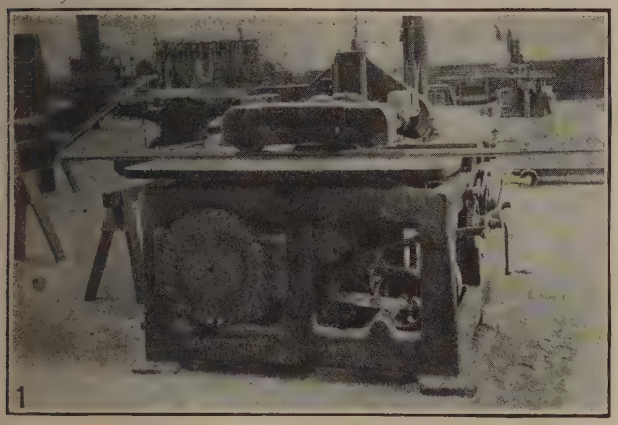
In the shops of the Washington Railway & Electric Company, Washington, D. C., boring of motor shells is done on a radial drill, and in the Spokane United Railway Company's shops at Spokane, Wash., a McCabe 72-in. double-spindle lathe is used.

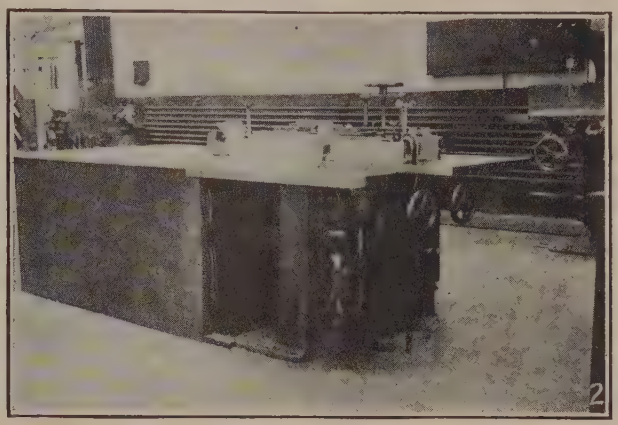
The Pittsburgh Railways uses a double-spindle horizontal boring machine for boring the axle and armature bearing housings of motor shells. The machine bores both bearing housings at both ends of the shell at the same time. This complete operation requires approximately three man-hours on this machine, while the same job on a single-spindle engine lathe would require nine man-hours. The time saving is effected by the elimination of three additional "set-ups" necessary on the ordinary engine lathe.

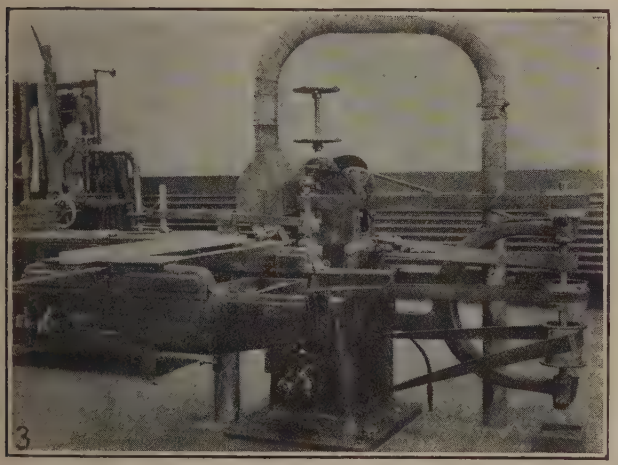
This gives an idea of the variety of methods and equipment used. An accurate comparison of the efficiency of the various methods is hard to determine, since the amount of rehabilitation work varies on different properties. In the methods where jigs are fitted to the motor complete the work includes not only the boring of the bearing fits but also motor shell caps and various redrilling of bolt holes. Some railways build up by welding and bore out to the original diameter, while others rebore to an enlarged diameter. The amount of work necessary is thus seen to vary widely with the different methods employed. It appears, however, that for the reboring operation alone a horizontal boring mill is the most efficient tool to use. This should be of double-spindle construction and should have an adjustment so that the distance between the spindles can be varied to suit various types of motors. The maximum distance between the spindles will be determined, of course, by the maximum distance between the armature and axle bearings on the motors being machined.

Another job on motor shells being carried out by the Philadelphia Rapid Transit Company is the finishing of some new end castings for motors. Originally these motors were of a non-ventilated type. The company is now replacing the end casting so as to provide for

ventilation. This work is being done on a Bullard vertical turret lathe. A total of nine cutting tools are used in the machining operation and the vertical head is equipped with five tools and the side head with four tools. In addition to the machine work in the vertical turret lathe, a considerable amount of drilling and spot facing is necessary. This work is done on a radial drill. The economies resulting from the use of these modern tools in connection with this work are considerable, and after this particular machining job is finished the tools will be available for other work which can be done much more economically on this class of equipment than on other older machine tools.







Four of the Modern Woodworking Machines that Helped Eliminate 90 per Cent of the Hand Work in the Cleveland Railway Carpenter Shop

1. Self-feeding rip saw. 2. Double-spindle shaper. 3. Tenoning machine. 4. Hollow chisel mortiser

Other Tools that Show Economy

Bolt-threading machines are tools that produce marked economies in connection with the maintenance of motor shells, as motor shell bolts become broken and the threads are burred so that it is necessary to re-thread them or provide new threads in the various nuts used. Bolt-threading machines in railway shops are kept very busy on other maintenance repair work in addition to that required for motors. A large number of bolts are used on electric railway equipment, and in addition there are many threaded rods, such as brake levers, truck rods and coupler parts. Turnbuckles are used for adjustment in the brake rigging and these require tapping. As these have both a right and a left hand inside thread, reverse motion of the bolt-threading machine is required. As the air brake equipment on cars requires considerable pipe, a combined bolt and pipe threading machine is of advantage, particularly on the smaller properties, which would not have sufficient work to keep a single-purpose machine of each type busy. A size which will take 1½-in. stock is large enough for the work on the majority of electric railways.

A special machine for a number of machine operations is the milling and boring tool, known as the Lucas "Precision" No. 32 milling machine, as used in the shops of the Cleveland Railways. On the particular operation shown in the accompanying illustration the machine is being used as a milling machine for finishing Westinghouse No. 340 axle bearing caps. Four milling cutters are mounted on the spindle of the machine. The large cutter in the center has side cutting blades, in addition to the usual surface blades. With such a combination of milling cutters, it is possible to finish the bottom, sides and shoulders of the cast iron bearing cap at one operation, following the building up of the cap by electric welding. A saving of 20 per cent in time has resulted by the use of this machine rather than a shaper for performing this particular job.

This "Precision" machine is also used for finishing truck pedestal jaws. The side member of the truck frame is placed in the machine in such a position that

the pedestal jaws are on top. A large size milling cutter finishes both sides and the top of the jaw. In doing this particular job the "Precision" machine effects a saving of 75 per cent in the time required to do the same operation on a shaper. The "Precision" milling-boring machine may also be used for boring 34-in. steel wheels.

Another job in the shops of the Cleveland Railways consists of drilling brake shoe heads for the brake pin on a three-spindle drill press. This operation is progressive and the machine is equipped with automatic feed and cutout. The cutout feature returns the drill to starting position. For this particular job of drilling the time required per head is approximately two and one-half minutes. When this work is done on a single-spindle drill press the time required for the operation is doubled.

Another drilling job consists of using a multiple-spindle horizontal drill for drilling cotter key holes in large size rods, bolts and brake pins. The machine has automatic feed and return for the drills. The action of the five drills is progressive, and the time required for drilling a ¼-in. hole in a 1-in. pin is one and one-half minutes. On a single-spindle drill press the same operation requires six minutes.

A serpentine shear has proved an extremely useful machine tool in the shops of the Chicago Surface Lines. Its cost is comparatively low and it will handle a wide range of sizes of sheet materials. The machine illustrated will take material up to ⅜ in. thick and can be used both for straight cuts and for making irregular shapes.

The Tool-Sharpening Machines Are Kept Separate

Emery wheels are set aside for grinding cutting tools in the Chicago shop. This results in improved workmanship and a considerable saving in expensive high-speed tool steel. For grinding castings and other rough work coarse-grained wheels on other grinders do faster work so that keeping the tool-grinding wheels separate is of advantage.

Modern machine tools are used in the woodworking department at the Harvard shops of the Cleveland Railways to such an extent that almost every operation in woodworking is performed by machine. A 12-in. molding machine which is capable of making almost anything out of wood is used for cutting tongued and grooved flooring, making floor strips, ceiling molding, car trim and other details of car construction. A hollow chisel mortiser is used for mortising buffer timbers and sills and members of the body underframe. In door construction and repair work the tenoning machine eliminates approximately 90 per cent of the time usually consumed by hand work. The machine cuts the tenon on the end of a door member and at the same time it cuts the recesses in the shoulder for receiving the molding of the mortised piece, thus saving additional handling.

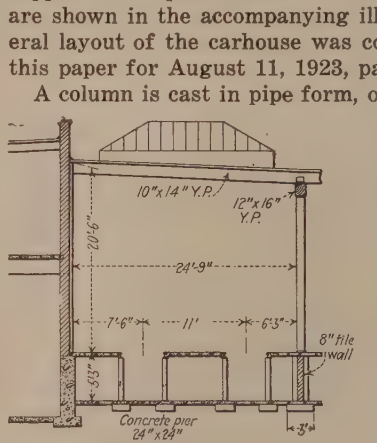
Cutting buffer timbers and sills is done on a self-feeding rip saw. It is possible with this machine to cut flooring out of large timbers.

A double-spindle shaper is used as a universal machine for cutting lighter work than the 12-in. molding machine. The double-spindle shaper, however, is capable of performing the same variety of work, being used for roughing out vestibule and car body corner posts and molding.

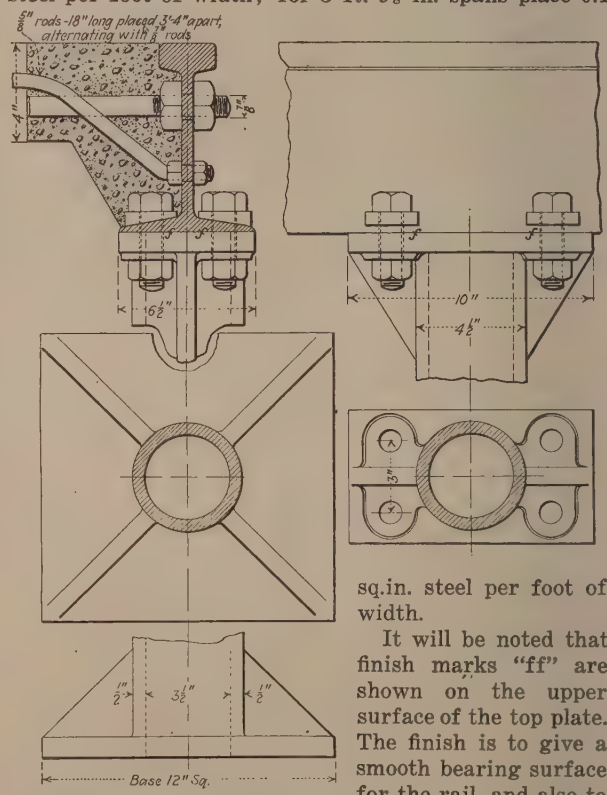
Carhouse Rails Supported on Cast-Iron Standards

IN THE United Electric Railways' new carhouse at East Providence, R. I., the rails in the pit section are supported on special cast-iron columns, of which details are shown in the accompanying illustrations. The general layout of the carhouse was covered in the issue of this paper for August 11, 1923, page 216.

A column is cast in pipe form, of 4½ in. outside diameter, with a square base and a rectangular top. The top is 10 in. long, measured along the rail, and 5½ in. wide, with four bossed holes for bolts to provide attachment to the rail, the base of which is drilled correspondingly. The columns are spaced about 10 ft. along the rail. The concrete runway which fills the space from track to track is of strongly reinforced concrete 4 in. thick. The reinforcing consists of ⅝-in. rods, 18 in. long, bent as shown, alternating with ⅞-in. tie rods for the rails spanning the complete width of the runway. The ⅝-in. rods are spaced 3 ft. 4 in. apart, alternating with the ⅞-in. rods, so that the distance between centers of adjacent rods is 20 in. The plans call for reinforcing of slab as follows: For 6 ft. 1¼ in. spans place 0.3 sq.in. steel per foot of width; for 3 ft. 9⅝ in. spans place 0.1 sq.in. steel per foot of width.



Cross-section of Part of East Providence Carhouse, Showing Rail and Walkway Construction



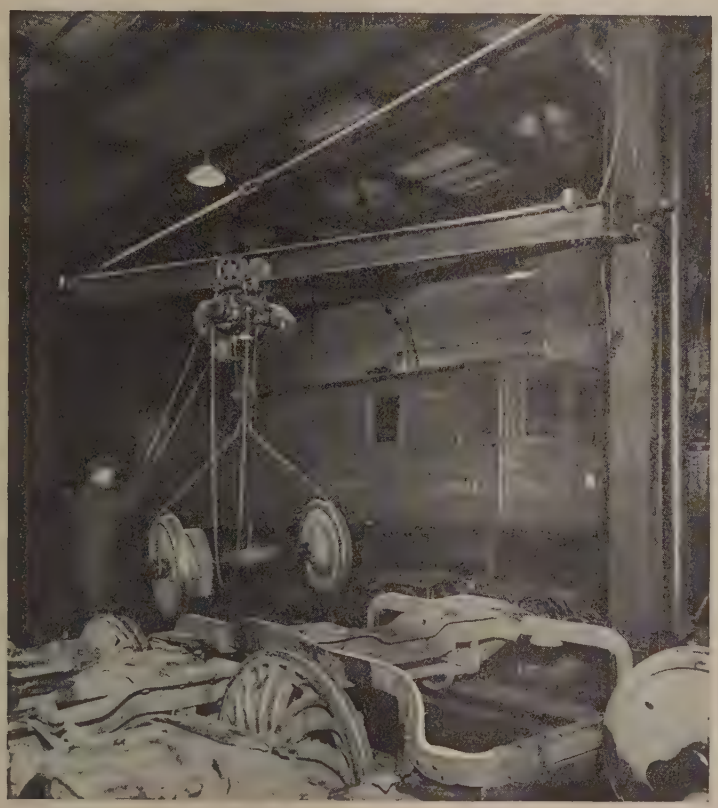
Details of Cast-Iron Column and Concrete Walkway Construction in East Providence

It will be noted that finish marks "ff" are shown on the upper surface of the top plate. The finish is to give a smooth bearing surface for the rail, and also to correct for inequalities in height.

A Picture Story Showing Many Uses to Which

Special Handling Equipment

Can Be Put in Electric Railway Work



Electric Hoist on a 10-In. Swinging I-Beam, in the Shops of the Worcester Consolidated Street Railway. Motors, Wheels and Trucks Can Easily Be Moved from One Track to Another with This Apparatus

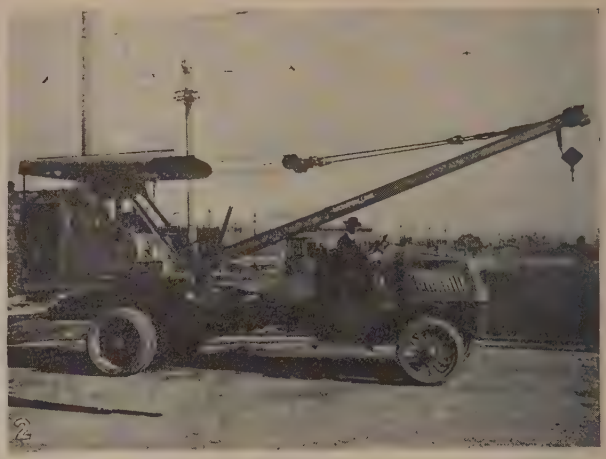
IN HANDLING MATERIAL and parts of every description, the electric railway industry has problems of peculiar difficulty compared with those of other industries. Much of the material to be handled and transported is extremely heavy. Wheels, axles, motor cases, rails, etc., are not only heavy but also unwieldy. On the other hand the electric railway has a distinct advantage in that it has electric power available to operate handling machinery, or compressors to provide an ample supply of compressed air.

Electric crane cars of various designs are used extensively. They have proved to be of great value as labor savers. For example, such a crane with a crew of one operator and two men can load or unload between 500 and 600 wooden ties per hour. Doing the same work by hand would require twelve men for some two and one-half hours. Moreover, the ties can be piled to a height of 18 ft. when the crane is used, compared with only 12 ft. when piled by hand. When handling cages of wood paving blocks a crane can dump approximately 18,000 blocks per hour. This would otherwise require twelve men for four hours.

It is the practice on some railways for the shop department to relieve the stores department of handling wheels, axles, motors and armature shafts. Special machinery is useful for transporting material from one portion of the storage yard to another, or from the storage yard to the shop. Pneumatic, electric and chain hoists are an essential part of such an arrangement. These are usually arranged to operate on an overhead monorail track of 8-in. or 10-in. I-beams. Switches and curves in the monorail system permit material to be transported quickly and easily around the shop.

Special handling machinery has been developed for various purposes. Electric shovels and caterpillar tractors are useful. Dump cars arranged to unload in the shortest possible time prevent interruptions to passenger car service. Loading machines can be used for numerous purposes.

A number of typical uses to which various electric railways are putting special handling equipment in the shops and yards, and on the street, are illustrated on the following pages.



Cranes and Shovels at Work

No. 1. 15-ton crane car built by T. M. E. R. & L. Co.

No. 2. An International crane mounted on a Mack truck is used by Cleveland Railway.

No. 3. Propelling Unit built by Differential Steel Car Company moves on car wheels or caterpillar tractor.

No. 4. Derrick with 100-ft. boom in Denver Tramway's material yard.

No. 5. Crane car built by Buffalo & Lake Erie Traction Company.

No. 6. Derrick with special tongs for handling rail.

No. 7. A wood insulating guard at outer end of boom is an interesting feature of this electric crane.

No. 8. McGuire Cummings 3-ton crane car used by Connecticut Co.

No. 9. A crane equipped with an electromagnet is used by the Boston Elevated Railway for handling iron scrap.

Mobility Features This Equipment

No. 10. Gravel being loaded into a Universal work car by means of a Thew shovel.

No. 11. A self-propelled hand operated derrick car for use in placing special work on the New York State Railways, Rochester.

No. 12. Thew shovel with caterpillar tractor used by T. M. E. R. & L. Co.

No. 13. Brownhoist used by the New York State Railways, Rochester.

No. 14. Self-propelled crane car equipped with a special clamshell bucket is used by the Los Angeles Railway.

No. 15. Power winch mounted on a White motor truck provides a convenient means to tear up old rails and ties.

The Time Element Is Important in the Loading and Unloading and Placing of Materials

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No. 16. Each of the four compartments of this car built by the Connecticut Company has a capacity of 6 cu.yd. It is dumped by electricity and can be unloaded in four minutes.

No. 17. Track rail is pre-welded by the Washington Railway & Electric Company and hauled to position in 420-ft. sections by a Fordson tractor.

No. 18. This Differential dump car is a big labor saver in handling track material for the New York State Railways.

No. 19. A Barber-Greene snow loader equipped with a transverse loading device designed by T. M. E. R. & L. Co. to facilitate rapid movement of the trucks. These proceed beside the loader in the direction of traffic without the necessity of backing into position.

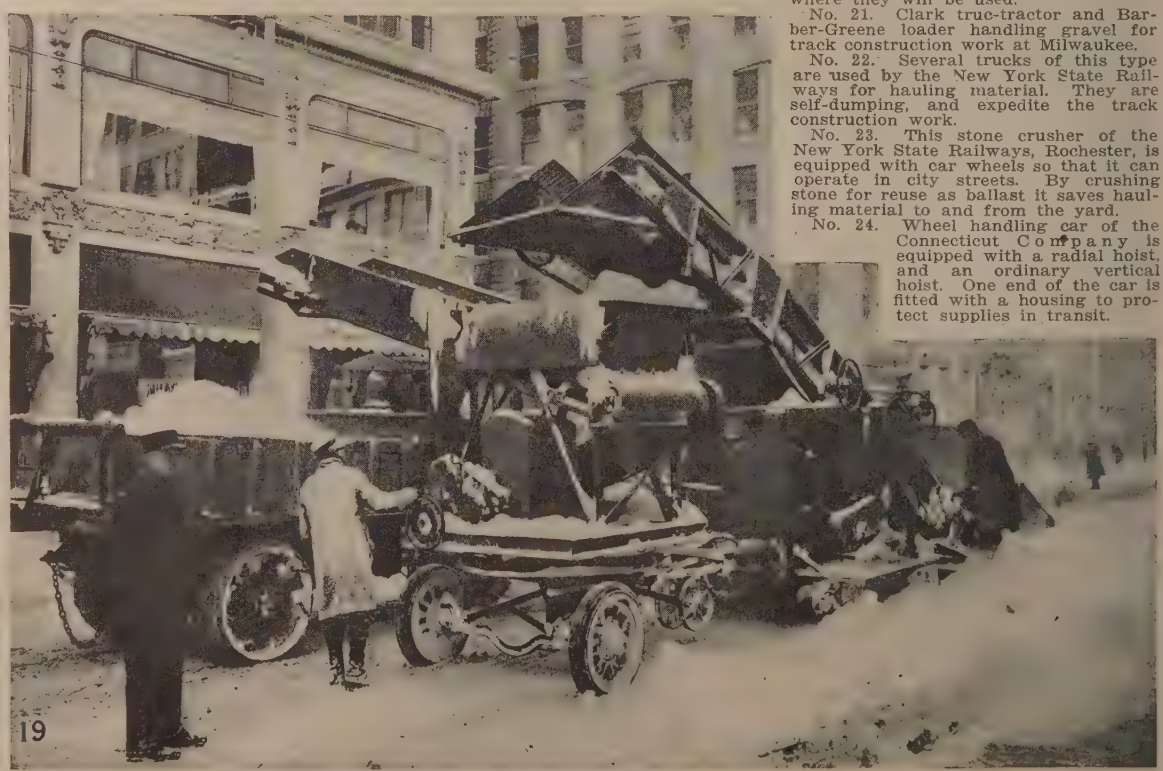
No. 20. A Cleveland caterpillar tractor is used at Milwaukee for hauling track and paving materials to the place where they will be used.

No. 21. Clark truc-tractor and Barber-Greene loader handling gravel for track construction work at Milwaukee.

No. 22. Several trucks of this type are used by the New York State Railways for hauling material. They are self-dumping, and expedite the track construction work.

No. 23. This stone crusher of the New York State Railways, Rochester, is equipped with car wheels so that it can operate in city streets. By crushing stone for reuse as ballast it saves hauling material to and from the yard.

No. 24. Wheel handling car of the Connecticut Company is equipped with a radial hoist, and an ordinary vertical hoist. One end of the car is fitted with a housing to protect supplies in transit.



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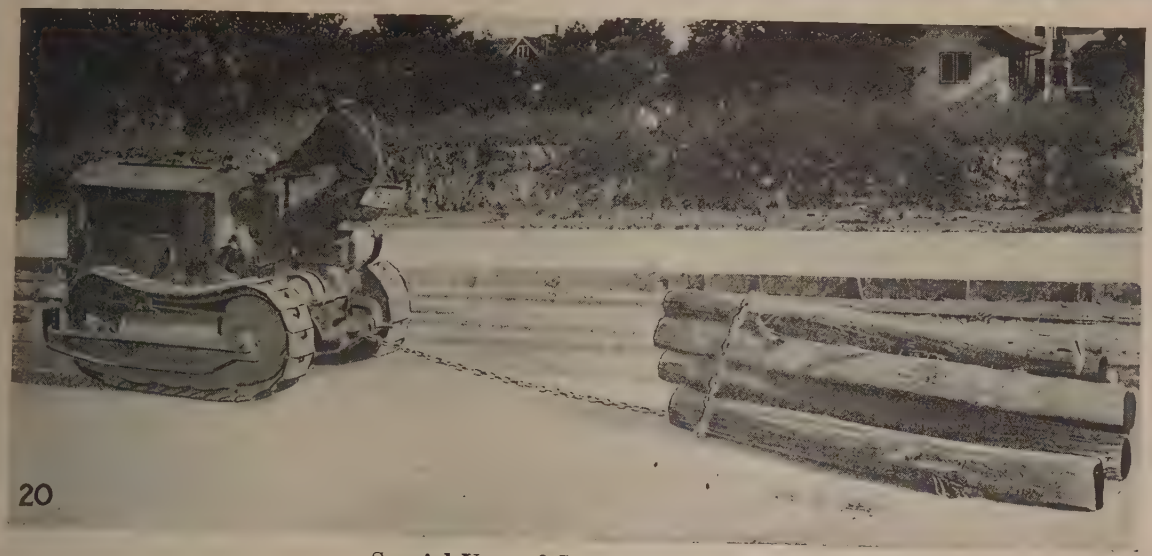
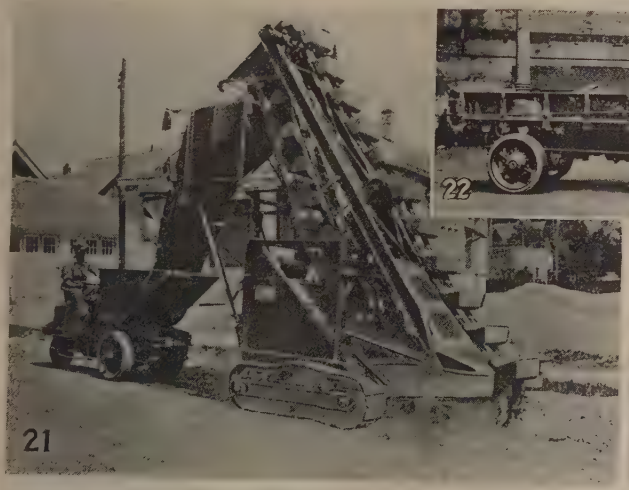
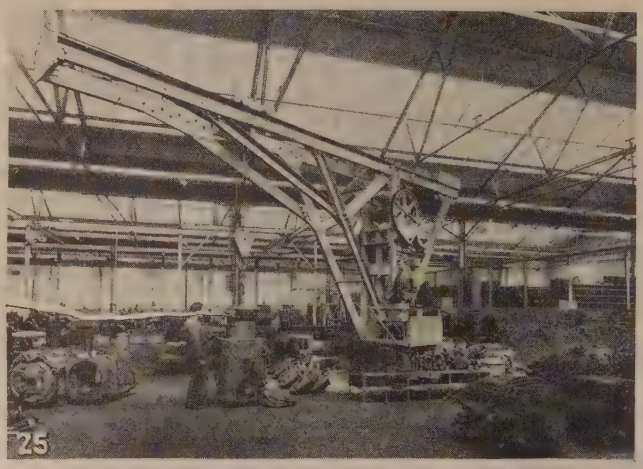


Special Uses of Special Equipment





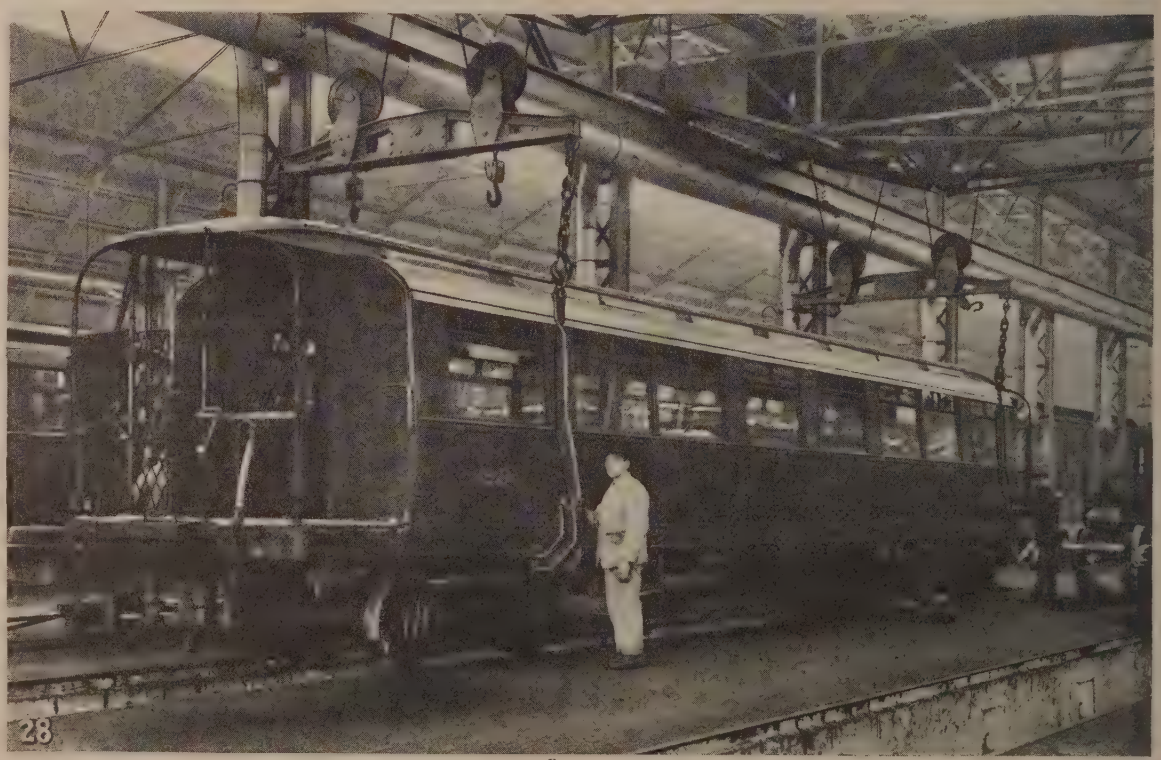
New Shops of the London Underground at Acton Have Unique Handling Machinery

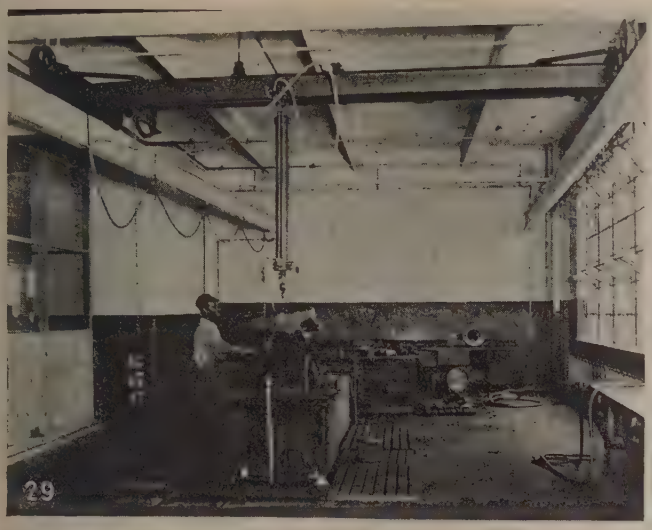
No. 25. A 3-ton jib crane in the new Acton shop of the Underground Electric Railways of London.

No. 26. A pedestal type crane at Acton equipped with yoke and multiple hooks.

No. 27. A traveling crane used in the truck overhauling shop of the London Underground.

No. 28. Method of lifting car bodies from the trucks at Acton. A pair of hooks is placed under the body at each end.





Hoists and Cranes Used in Shops

No. 29. This small capacity pneumatic hoist is convenient for handling such parts as gear cases, motor and armature bearings.

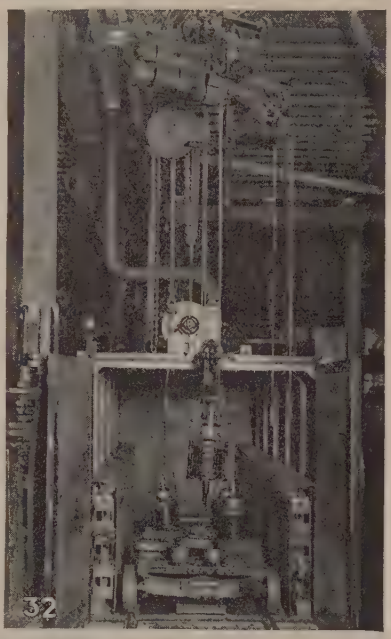
No. 30. Heavy air hoists used by the Saginaw Transit Company to raise car bodies from the trucks. These are mounted so as to hang just outside the car body and can raise a 40,000-lb. steel car.

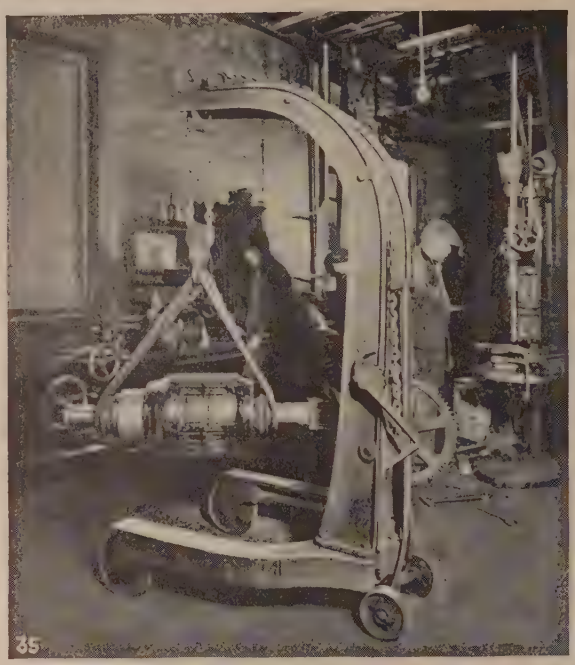
No. 31. Thor 2-ton pneumatic hoist used for handling car wheels, axles, motors and armature shafts, by the Chicago Rapid Transit Co. This hoist is one of two used on a monorail system.

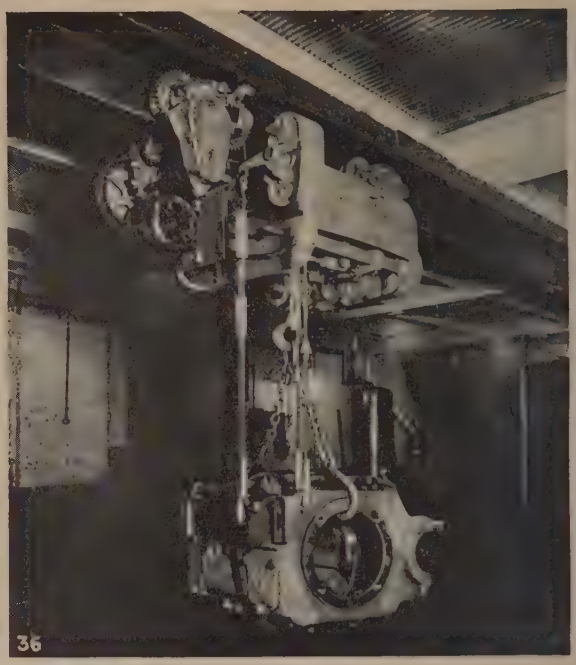
No. 32. In the shops of the Long Island Railroad the armature room is equipped with an overhead monorail system and pneumatic hoists.

No. 33. A complete monorail system has been installed in the shops of the United Railways of St. Louis. Each important machine tool handling heavy material is served by a jib crane with an air or chain hoist. Switches in the overhead rail system allow materials to be transported anywhere in the shop.

No. 34. Overhead Toledo crane used for handling motors, trucks, and other heavy parts in the shops of the Cleveland Railway.







Shop Efficiency Is Promoted by Having Convenient Handling Equipment

No. 35. For handling armatures while making bench repairs a portable hoist has been found a great convenience in Rochester.

No. 36. This 4,000-lb. crane has been found particularly serviceable in the motor repair department of the East St. Louis & Suburban Railway. Not only armatures, motor shells, etc., but also completely assembled motors are handled.

No. 37. A 1-ton Imperial hoist mounted on a swinging I-beam 8 ft. long. The boom swings from a center bearing on the door jamb.

No. 38. A chain hoist is used effectively for handling armatures to and from the racks in the shops of the Connecticut Company.

No. 39. Yale & Towne chain hoists used for raising car bodies in the shops of the United Railways & Electric Company of Baltimore.

Large Air Compressor, Locomotive Crane, Air-Operated Pile Driver for Breaking Pavement, Work Car and Electric Shovel in Use in Reconstruction of Track on Oneida Street in the Center of Milwaukee

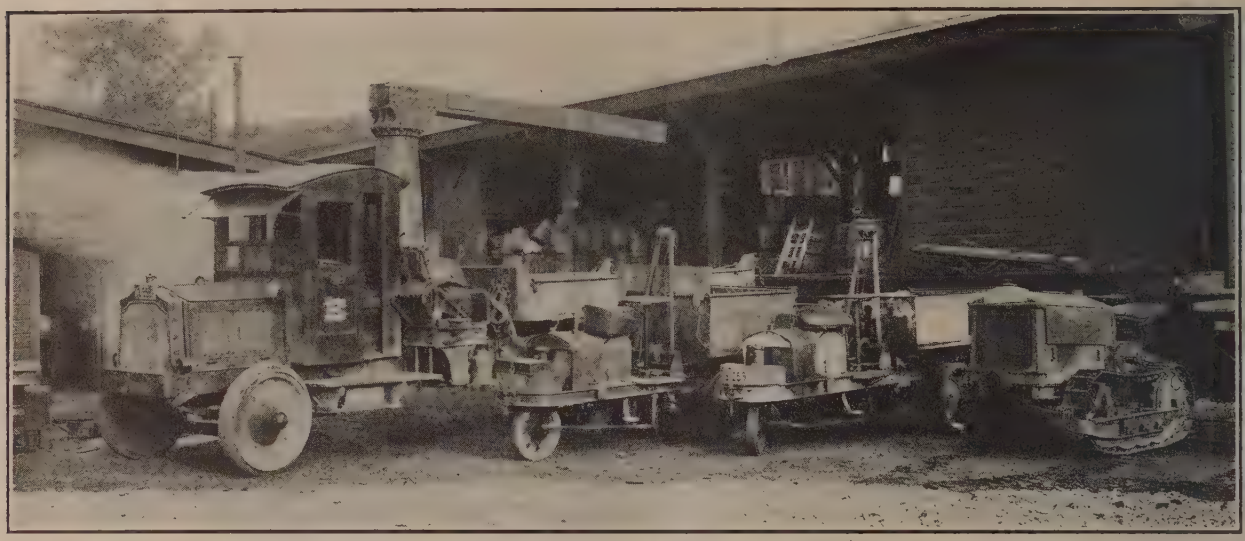
Keeping Track Machinery "on the Job"

Track Maintenance and Reconstruction in Milwaukee Expedited by the Use of a Large Variety of Machine Equipment in Charge of a Special Division—Each Job Is Charged at Predetermined Rental Rates to Cover Equipment Costs

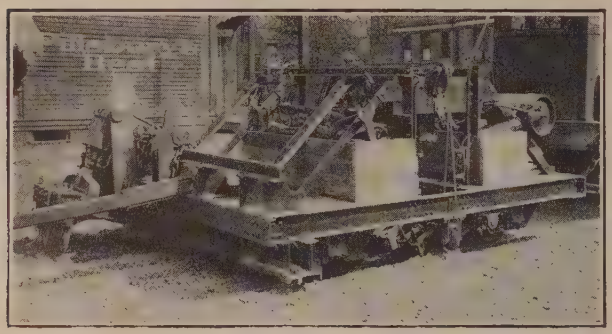
SUBSTITUTION of machines for hand labor has been a consistent policy of the way and structures department of the Milwaukee Electric Railway & Light Company. A large variety of machine equipment has been acquired under the supervision of R. H. Pinkley, engineer of way and structures, as a means for expediting track maintenance and reconstruction. Intensive study of the various kinds of work carried out by the department has also led to the construction of special machines and to the development of improvements in standard construction machinery to increase their utility in track reconstruction work. Whenever possible, manufacturers have been induced to make improvements in their apparatus according to the department's suggestions, but in some cases entirely new machinery has been developed and constructed by the railway. When the purchase of new equipment is contemplated the selection is made so as to obtain machines adaptable to as wide a range of jobs as possible. The variety of work which can be handled by a proposed new machine is carefully considered and an estimate is made of the probable hours of use per season. At the same time the estimated fixed charges and operating costs are weighed against the saving in labor to be expected. Thus the purchase of expensive machinery which can be used only at infrequent intervals for short periods of time is avoided.

In addition to the care taken in the selection of new machinery, a consistent effort is made to secure maximum utilization of the equipment which is owned. As organization plays a large part in accomplishing this result, all machinery of the department is placed in direct charge of a special division, headed by a supervisor of equipment. The men of this division are carefully selected and are experienced in the operation, inspection and maintenance of the various machines used by the department. Machines are assigned to various jobs by the supervisor of equipment on request of the construction foremen. Trained operators are assigned to accompany each important machine. Each of these operators is responsible to the supervisor of equipment for the condition of his machine while on the job. On equipment which is kept in continuous service during the construction season, the operators are allowed an extra half hour morning and evening for inspection, cleaning and oiling. These trained mechanics take care

Reinforced Concrete Paving Is Facilitated by Use of Machinery. New Finishing Machine Now Under Construction Will Give Still Further Economies



A Battery of Material-Handling Equipment Used by the Milwaukee Company in Trackwork



A Scarifier Built by T. M. E. R. & L. Co. Does Effective Work in Ripping Up Macadam Paving

Rubber Tires and Spring Mounting Cut Maintenance Costs on Equipment

The Scarifier Is Operated in a Train and Is Followed by a Scraper, Which Throws the Broken Paving to One Side of the Track

of ordinary field repairs. In the event of a serious failure in the field additional mechanics are immediately assigned by the supervisor of equipment to transport repair parts and to aid in making repairs.

A carefully worked out system of accounting covers fixed charges and total operating costs of the way and structures equipment. The apportionment of the cost of each individual machine is calculated in the form of a rental charge which is made directly against the individual job on which the machine is used. This practice tends to stimulate the greatest possible utilization of existing equipment, as each job is charged with the day rate on the machines assigned to it until such time as they are released from the job by the construction foreman. This accounting method has an additional advantage in that it gives the true cost of any construction or reconstruction job, including all of the machine rental charges which would be made if the work were carried on by an independent contractor.

Differential Dump Cars Used in This Case to Haul Away from the Job Removed Paving Loaded by Electric Shovel

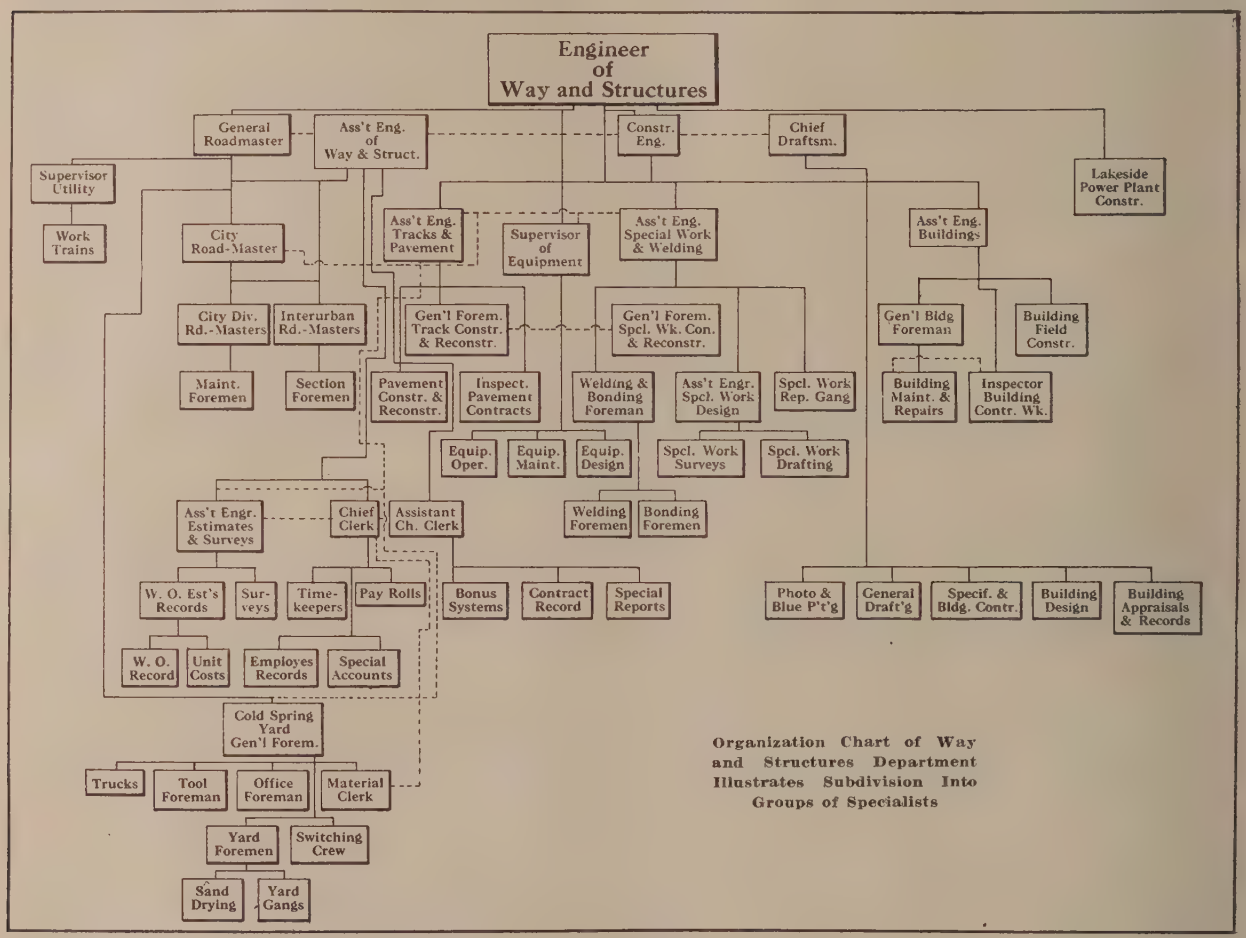
During winter months, when construction work is not in progress, the men of the equipment division are kept busy in the general inspection and overhaul of machinery belonging to the way and structures department. The number of men employed by this department varies between fifteen and twenty. Their work during the winter makes them intimately familiar with the design and construction of the various pieces of equipment which they are called upon to operate during the summer. They are particularly well fitted for taking care of emergency field repairs to their machines and to make frequent inspections so as to detect worn or weak parts before actual failure ties up the machine when it is required on a job.

A plan which was inaugurated during the winter of 1922-23 has been of additional value in impressing on the men of the department who handle its machinery the importance of proper care while this equipment is in the field. The various division foremen, equipment men and others in the way and structures department attended a school conducted under the direction of the general education department of the company. Instruction was given in some of the fundamental principles of mechanics and applied electrical practice. In addition, the importance of the proper maintenance and lubrication of track machinery was stressed. Damaged machines were used as examples to illustrate the effects of improper care. In view of the increasing use of machinery by the department it has been felt that this form of instruction is of immense value in impressing on employees the importance of proper care.

The supervisor of equipment and two of his assistants are provided with Ford roadsters equipped with wagon-box bodies and a supply of hand tools, so that during the construction season they are able to move rapidly between various jobs in order to take care of emergency repairs to equipment. When major shop repairs are required the work is done by regular shop forces, but in most cases one or more of the equipment specialists are assigned to the shop with the machine and supervise the repair work. The supervisor of equipment issues orders for such shop work and requisitions materials and parts that are required.

Various classes of work carried on by the way and structures department are handled by groups of specialists as far as possible. Each of these groups is headed by a supervisor, and the various groups of specialists take their place in any particular reconstruction job under the direction of a general foreman. Some of the more important classifications of work include the following: (1) Equipment; (2) bonding, welding and grinding; (3) special work repairs; (4) asphalt and bituminous pavement repairs; (5) concrete paving gang; (6) utility and work train service, under the head of a supervisor of utilities.

Similarly to the above classes of field forces, the staff forces of the department are subdivided into groups of specialists. Two of the more important of these groups are: (1) A civil engineering division, which does all survey work and civil engineering for the entire company, including the electrical properties; (2) a drafting division, which prepares all drawings for the department, designs special work layouts and special machines, prepares blue prints and photographs, and does all of the architectural work for the company. In addition to these, there is a building maintenance division and a building construction division. The maintenance of way forces are organized in territorial divisions, each headed by a division roadmaster. These include three city divisions and three interurban divisions. The general organization of the way and structures department is shown in the accompanying chart.



Organization Chart of Way and Structures Department Illustrates Subdivision Into Groups of Specialists

Since pneumatic tools are used in trackwork to a very wide extent a full complement of portable air compressors is required. These include one compressor of 225-cu.ft. per minute capacity, three 150-cu.ft. compressors, six 110-cu.ft. compressors and two 90-cu.ft. machines used for small maintenance work. Most of the compressors used are of a slow-speed type, considerably heavier than higher speed compressors of the same capacity. The slower speed machines, it is claimed, are more substantial in their construction and give lower maintenance. Most of them are mounted on spring-suspension, rubber-tired trailers to reduce vibration while they are being hauled from job to job by means of motor trucks. The 225-cu.ft. machine and one of the 150-cu.ft. machines are mounted on flanged wheels for operation on railway track.

An interesting development has been made in connection with the method of cooling these compressors. It was felt that water cooling for track department equipment of this kind was a source of considerable trouble, particularly in early spring or late fall, when carelessness during a sudden cold snap might result in cracked water jackets. Instead of using water, the compressed air is passed through cooling coils to the reservoir and then is led back through the cylinder jacket chambers to act as a cooling agent. It is reported that this plan gives satisfactory results.

Concrete breakers, tie tampers, jack hammers and pneumatic drills form the largest group of track tools requiring compressed air supply. For breaking up old concrete paving, a steam-hammer type pile driver has been found very effective. This is mounted on two supporting skids and moved from spot to spot by means of a crane car, as shown in an accompanying illustration. It is operated by air instead of steam and is available for use not only in breaking concrete but also for driving piling on various construction jobs around the property.

Both air and electric track drills and spike drivers are used. Since the adoption of concrete for paving, it has been considered important to obtain a type of track drill capable of being used in very close quarters so as to limit the size of openings required in the concrete paving for making track repairs. To meet this requirement a new type of close-quarter mechanical-drive drill

TABLE I—ANNUAL MAINTENANCE AND FIXED CHARGES FOR TRACK EQUIPMENT IN PER CENT OF ORIGINAL COST, MILWAUKEE

	Depreciation	Shop Repairs	Field Repairs	Storage and Incidentals	Insurance	Taxes	Total
Bonding machine	10½	6	10	3½	1	1	32
Air compressor, electric	12½	6	3	3½	1	1	24
Air compressor, gasoline	18½	6	7	3½	1	1	37½
Cement gun	7½	4	5	3½	1	1	22
Drill, electric track	10	5	10	3½	1	1	30½
Grinder	10½	5	10	3½	1	1	31
Hammers, air	15	5	5	3½	1	1	30½
Heater, tar and gravel	15	3	5	3½	1	1	28½
Hoist, electric	9½	5	3	3½	1	1	23
Loader, gasoline	15	10	6	3½	1	1	36½
Loader, electric snow	5	2	3	3½	1	1	15½
Mixer, electric	12½	12	4	3½	1	1	34
Mixer, gasoline	18½	13	8	3½	1	1	45½
Paint spray gun	10½	3	5	3½	1	1	24
Pump, gasoline	9½	2	4	3½	1	1	21
Roller	7½	5	3	3½	1	1	21
Saw, rail	7½	5	5	3½	1	1	23
Scarifier	12½	10	8	3½	1	1	36
Shovel, electric	10½	6	5	3½	1	1	27½
Signal, Nachod	7½	3	3	3½	1	1	19
Spike driver	5	3	4	3½	1	1	17½
Tampers, air	15	4	5	3½	1	1	29½
Trailer	9½	2	3	3½	1	1	20
Tractor, gas, wheeled	12½	9	5	3½	1	1	32
Tractor, caterpillar	15	15	10	3½	1	1	45½
Welding machine	10½	6	10	3½	1	1	32
Bucket, grab	10½	5	3	3½	1	1	24
Jim Crow	10½	2	3	3½	1	1	21

TABLE II—ESTIMATED ENERGY CONSUMPTION OF TRACK EQUIPMENT TO BE CHARGED AGAINST SPECIAL ACCOUNT FOR EACH DAY'S USE

Pieces of Equipment	Description	Hp. Motors Each	Kilowatt Capacity	Average Kw.-Hr. Daily
2	Bonding machine (Lincoln) 20 to 60 amp....	...	.....	15.
2	Compressor, 150-ft	27	20.142	60.
3	Compressor, 110-ft	20	14.92	45.
2	Compressor, 90-ft	15	11.19	35.
1	Compressor, 10-ft. preheater	2	1.49	2.5
8	Drill, track—Duntley	1	0.74	2.
4	Drill, tie boring machine	½	0.373	1.
1	Drill, electric breast	1	0.746	0.5
2	Grinder, swing frame-shop built	3	2.238	5.
2	Grinder, Atlas rail	7½	5.595	14.
1	Grinder, Goldschmidt thermit	7½	5.595	15.
1	Grinder, Reciprocating rail	3½	2.611	6.
1	Grinder, Universal rotary	3½	2.611	6.
5	Grinder, Little Giant portable	1	0.746	2.
4	Grinder, flexible shaft	1½	1.119	2.
1	Hoist, P. & H. Co. 18 hp	18	12.429	30.
2	Loader, B. & G. Co	10	7.46	3.5
1	Mixer, Rex	15	11.19	20.
2	Mixer, Koehring, Nos. 14 and 14-E	15	11.19	15.
2	Mixer, Koehring, Nos. 6 and 14-E	7½ & 5	4.476	8.
1	Saw, rail, mounted on truck	1	0.746	2.
1	Scarifier—mounted on single-truck flat car	2	1.492	no power
2	Shovel, Thew electric	20	14.92	50.
1	Shovel, Thew electric caterpillar	20	14.92	50.
2	Signal, Nachod	...	.....	.....
6	Spike driver, Duntley Nos. 3 and 4	1	0.746	0.5
2	Welder, Lincoln Type W. 60 amp. and 35 amp.	...	.....	30.
2	Welder, General Electric	7½	5.595	15.

TABLE III—DAILY RENTAL RATES ON WAY AND STRUCTURES EQUIPMENT

Description	Days Use per Year	Daily Rental Rate
Bucket, grab	50	$2.00
Buster, concrete	75	0.75
Compressor, electric air, 150-ft	150	6.75
Compressor, electric air, 110-ft	150	5.00
Compressor, electric air, 90-ft	150	4.00
Compressor, gasoline air, 90-ft	150	4.00
Drill, Duntley electric	250	0.60
Drill, Little David air	250	0.60
Drill, tie boring, electric	100	0.45
Drill, tie boring, air	150	0.30
Grinder, swing frame	175	1.35
Grinder, Atlas rail	175	2.25
Grinder, Goldschmidt thermit	175	3.50
Grinder, Reciprocating rail	175	4.50
Grinder, Universal rotary	175	3.25
Grinder, Little Giant portable	100	0.35
Grinder, Little David air	100	0.45
Hammer, (Air Jackhammers)	75	0.70
Heater, combination tar and gravel	100	4.00
Heater, three-burner surface	50	1.00
Jim Crow, hydraulic	50	1.50
Kettle, type D tar and asphalt	100	2.00
Loader, electric (snow work)	100	2.75
Loader, gasoline	150	8.50
Mixer, electric concrete, 21-E Rex	150	13.50
Mixer, electric concrete, 14-E Koehring	125	6.75
Mixer, electric concrete, No. 6-6 Koehring	100	6.75
Mixer, gasoline concrete, (½-bag)	125	2.25
Mixer, electric concrete, (1-bag)	100	3.00
Roller, steam	125	3.50
Roller, gasoline	125	3.25
Scarifier on single-truck flat car	100	10.80
Shovel, Thew electric rail	100	16.40
Shovel, Thew caterpillar	150	21.00
Spike driver, Duntley No. 3 and No. 4 elect	175	0.20
Tamper, Ingersoll-Rand air	50	1.00
Trailer, Lee four-wheel 3-ton	100	3.00
Tractor, Cleveland caterpillar	175	5.00
Tractor, three-wheel Clark	175	3.00
Welding machine, Lincoln and G. E.	175	3.25

Hoist Dump Tractors Are Particularly Useful in Distributing Paving Material

has been developed and is being built in the company's shop. It is the intention to drive this drill by means of a flexible shaft from the motors on some of the rail grinders. All ties for tangent track are adzed and bored by machine in the material yard. A friction rail saw in the yard has also proved to be a considerable time and labor saver.

Several types of grinding equipments are utilized. Three Atlas rail grinders are used very largely to follow up top welding work such as that at cupped joints and special work repairs. A Goldschmidt grinder, in addition to its use for finishing thermit-welded joints, has been found particularly useful for grinding throatways in special work. In addition to this equipment, one reciprocating track grinder is used for removing rail corrugation and three specially designed and constructed portable swing frame grinders have been found particularly useful for roughing down thermit welds and for grinding the taper in special work throatways.

Considerable macadam and asphalt paving has been laid in the past. For tearing up macadam an air-controlled scarifier, shown in an accompanying illustration, has been found very effective. It consists of a heavily loaded trailer equipped with specially designed teeth that rip up the pavement. On asphalt a rugged knife clamped to the edge of a steam roller frame has been found to give very good results for cutting the pavement along a straight line at the edge of the track zone.

The scarifier is used in a train in which it is followed by a plow consisting of a heavy scraper mounted on a flat car. Following along behind the scarifier, this plow

Heavy-Duty, Slow-Speed Air Compressors Are Used for Field Work

forces the material cut loose by the scarifier over to the outside of the track. The train with scarifier and plow may be seen in an accompanying photograph.

The Milwaukee company designed this scarifier when it had occasion a couple of years ago to remove 85,000 sq.yd. of paving. It comprises a heavy steel frame supporting castings which carry the scarifier teeth. These are raised and lowered by compressed air. They are arranged so as to take in the entire track zone of a single track or one side of a double track up to the middle of the dummy strip. The teeth can be set down to cut 3 in. deep in one passing, and the scarifier is used to cut down into the paving surface from 3 in. to 7 in. when removing old macadam or other material in preparation for building a new asphalt surface, or in going down to the tops of the ties for installing concrete pavement.

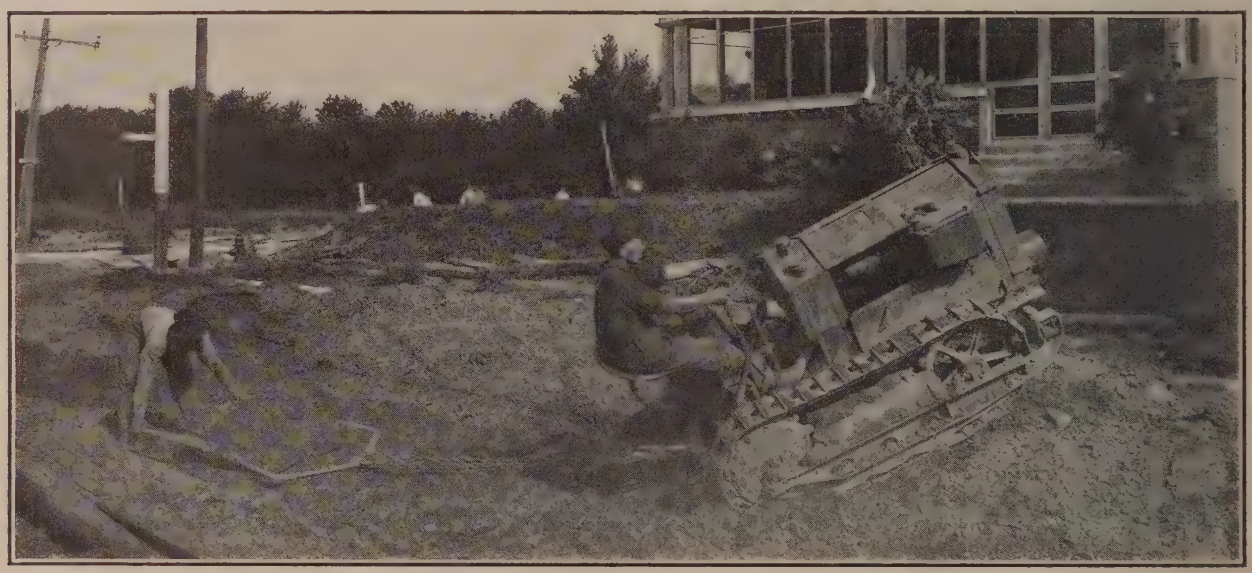
For handling the large quantities of heavy materials that are required in trackwork, a very complete group of equipment is available. A 3-ton derrick and a 15-ton electric drive Brownhoist locomotive crane with a 50-ft. boom are permanently located in the material yard for handling rails, ties and other heavy supplies. For construction work on the street a 15-ton Industrial derrick car, equipped with a 30-ft. boom and an extension boom for handling rails, is available. In addition, a 10-ton Brownhoist derrick car is used a great deal for handling heavy materials and in street construction work. It is equipped with a 30-ft. telescoping boom which can be extended to 45 ft. for handling rails. Three Thew electric shovels facilitate excavating work. One of these, equipped with a $\frac{5}{8}$-cu.yd. bucket, is used for loading gravel at the company's own gravel pit, and two others, equipped with $\frac{3}{4}$-yd. buckets, are used in street construction work. One of the latter is mounted on flanged railway wheels and the other is equipped with caterpillar treads so that it can easily be manipulated around construction work. Two Cletrac caterpillar tractors have been found particularly serviceable for miscellaneous hauling. Equipped with snow plows, they are also available in the winter for clearing yards or other places not readily handled by the regular rail snow equipment.

Three-wheel Clark truck tractors with 1-yd. dump bodies are used in connection with concrete paving and also for handling materials used in construction work. Three of these have gravity dump bodies and on the remaining two the bodies are of the hoist dump type so that the load can be discharged as desired. An additional four-wheel tractor of 1-ton capacity with a gravity dump body has been found useful for opening and closing gangs on miscellaneous track repair work.

Several types and sizes of paving rollers are utilized. These include one 10-ton gasoline roller and two 7-ton rollers. One of the 7-ton machines is steam driven, while the second has been converted to electric drive and is operated by means of a cable mounted on a drum which takes up the slack as the roller is moved back and forth. An additional 5-ton Galion gasoline tandem roller is used in connection with asphalt repair work.

Extensive use of concrete has led to the adoption of a variety of mixers and paving machines together with material loaders for meeting the requirements of different types of jobs. A Rex chain belt 21-E mixer mounted on rubber tires is used for large paving reconstruction jobs. For large special work construction a No. 14 mixer equipped with a 20-ft. boom and distributor bucket gives good results. This machine is mounted on steel-tired wheels which are so arranged that flanged rims can be bolted on for operation on the track rails to reach all parts of the street opening. Two No. 6 Koehring pavers are particularly useful for small special work jobs and grouting work. Barber-Greene bucket loaders with measuring hoppers facilitate the work of handling gravel, sand and similar materials. A complete equipment of dump cars is used to transport paving and other materials. This consists of 7 Differential dump motor cars and 18 Differential trailers, one of which is the door chute type, together with six 20-yd. center dump, steel Koppel cars.

A new cement skip has just been developed for dumping a four-bag load into a Clark tractor so as to avoid tying up the tractor while individual bags are being emptied. A concrete finishing machine is also being completed in the railway company's shop and is designed to meet the special requirements of track zone paving.



The Tractor Speeds Up Grading and It Will Go Anywhere

Rubber-tired equipment is used wherever possible, as it has been found that the hauling of heavy machinery over pavements by motor vehicles results in severe vibration and shock. The saving in maintenance which is obtained by applying rubber-tired wheels and spring suspension gives a substantial reduction in the wear and tear on equipment.

How Machine Costs Are Accounted For

The distribution of machine costs to various construction jobs on a rental basis, as mentioned earlier in this article, is accomplished by a simple accounting system which includes all of the various items of maintenance, operating cost and fixed charges. This was worked out after a detailed study of the subject was made by the way and structures department.

The former practice was to charge the cost of supplies and maintenance of the equipment into an annual tool work order which was cleared out annually to the various construction jobs in proportion to the pay-roll costs. This method provided no way of equitably distributing fixed charges on the equipment.

Under the new arrangement, fixed charges, depreciation, insurance and taxes, together with maintenance and operating costs, are all accumulated in a special account. Table I shows the rate of depreciation used for various types of equipment. The operating charges to the special account are divided into four general subdivisions as follows: (1) Miscellaneous supplies and expenses, including oil, grease, gasoline, waste and other materials and supplies used in the operation of the equipment; (2) power cost, based on the daily use of each machine; (3) maintenance of equipment, including repair parts, labor and sundries, but not general replacements or renewals of equipment; (4) maintenance of equipment buildings, fixtures and grounds, including all charges against buildings devoted exclusively to the storage of equipment used by the way and structures department.

Using the estimated number of days use per year as a basis, the total fixed charges, maintenance and operating costs for the various pieces of equipment as shown in Tables I and II have been compiled for each class of equipment to give a daily rental rate. From reports made by field men to the accounting department, each construction job is charged with all equipment on that particular job. As these charges are made, the general equipment special account is credited with corresponding amounts, so that at the end of the year the total annual cost of the equipment has been charged out against the individual jobs on which it was used. Minor adjustments in the estimated rental rates are made when required, so that the various charges balance with the special account at the end of each year.

Line Practices on Pittsburgh Railways

The Materials, Construction and Equipment Used by This Large City System, Together with the Maintenance and Emergency Organization Employed, Are Briefly and Helpfully Discussed — Recent Storm Tests Merit of Line Department's Work

By H. A. Pharo
Superintendent of Lines Pittsburgh Railways Company

THE Pittsburgh Railways Company, like many other large systems, is composed of several smaller properties which have been combined under one ownership and management. While under independent operation these companies had constructed their lines according to individual ideas. When the combination was effected, it was naturally expedient that methods of construction and materials be made uniform for the entire system.

A department of lines was organized under a superintendent and the system divided into eight districts or divisions with a line foreman in charge of each division. The personnel of each division are classified as linemen, emergency men, line helpers, emergency helpers, bonders, groundmen and drivers according to the character of their work. Each division has its own complement of tower vehicles and line cars, proportioned in number to the mileage of lines to be maintained over paving or T-rail trackage on private rights-of-way.

The duties of the department were originally confined to line construction and maintenance, but the passing years have broadened its scope until at the present time it is correlated more or less with the activities of all other operating departments. Some of the various responsibilities will be referred to in the succeeding paragraphs.

Line maintenance seems to be a more or less prosaic subject and does not generally arouse the enthusiastic interest accorded descriptions of smooth track, carefully planned carhouses, resplendent rolling stock and architecturally beautiful substations. To the busy street railway man the lines are a necessary adjunct to the business of transportation for the purpose of delivering motive power, but something often to be ignored until there is a service interruption due to a trolley break or similar cause.

The layman sometimes views the lines as a combination of poles and wires which he reluctantly admits must be tolerated. Said layman is prepared at all times, however, to advance unlimited arguments that a pole could be more advantageously located on his neighbor's frontage, rather than on his own, or that it is perfectly reasonable to request a 50-ft. move to clear an 8-ft. driveway to his new garage, when a few feet would suffice.

The Pittsburgh district, with its narrow streets, steep grades and sharp curves, presents the maximum difficulties for the successful operation of an electric street and interurban railway system. It is probably true that the line construction of the Pittsburgh Railways Company's system is not essentially different from that of other large systems, nor does the writer wish to convey the impression that radical departures have been made from existing practices.

The department of lines has its problems due to the topography and atmospheric conditions of this district, and that some of them have been solved is evidenced by the record of February 19 and 20 this year. On that night the most severe sleet storm in local history visited the Pittsburgh district. With a total of 1,500 miles of trolley, feeder transmission, signal and other wires only eighteen breaks occurred. Six of these breaks were caused by sleet cutters and the balance by ice incrusted trees and foreign circuits, which by reason of their weighted condition were unable to withstand the violence of the high wind. There was not a pole broken nor disturbed, nor even a case of "hot" pole, and cars were kept in continuous operation on all routes in order to break the coating of ice on the trolley wires. Since all day runs were started out on schedule time in the morning the department of lines is naturally inclined to be proud of this record and considers that its efforts have not been in vain.

Typical Wood Pole Construction on Private Right-of-Way, Showing High-Tension, Feeder and Span Construction on the Same Pole Line

In maintaining the lines of the system it has been found that best results can only be obtained by constant inspection and repair. Every mile of line construction is inspected thoroughly and repaired or adjusted if necessary once each week. Where headways are close and wear is consequently greater, inspections are made at more frequent intervals. The old proverb that an "ounce of prevention is worth a pound of cure" applies admirably to the upkeep of lines. Minor repairs and adjustments made promptly when distress first appears save large expenditures which would later become necessary if the small faults were neglected.

Trolley inspection and repair are carried on by the familiar tower vehicle. Both tower trucks and horse drawn tower wagons are in use at the present time, but a complete motorizing program is well under way, and in a brief time trucks will be used exclusively.

A tower crew consists of lineman, helper and driver, and each crew is assigned a district for which it is responsible. By constant association daily, except Sundays and holidays, the lineman becomes intimately familiar with all the peculiarities of his district and is thus able to render more efficient service.

Pole and feeder inspection and repair are carried on by special crews on each division. This branch of work, classed as heavy, requires a force of men equal to the average requirements and the tool equipment corresponds to the nature of the work. Work of this class is carried on under the direction of the head lineman or assistant division foreman and line cars are generally used for transporting men and tools.

A total of twelve tower trucks and wagons and six line cars are required to care for the maintenance and construction of lines and other departmental activities.

The slogan of the Pittsburgh Railways Company is "Safety Always" and the safety movement pervades the entire organization of the lines department. Each truck, wagon and line car is equipped with only the best tools obtainable and in ample assortment, including rubber boots, coats, hats, gloves and safety blankets.

Emergency Crew Work and Equipment

Located within the area of heaviest traffic are six emergency stations of the line department, at each of which a crew, consisting of two men, is always on duty during the twenty-four hours. The duties of the emergency men are manifold as their title implies. They are prepared to handle troubles of any description which are causing traffic interruption, or may interfere with regular car movement. When the emergency service was first established wagons drawn by two horses were employed to transport men and tools. Later, light motor trucks were substituted. Recently all the light trucks have been replaced with a fleet of Autocar 3-ton trucks. In designing the bodies of the present trucks the experience of preceding years was the guide, with the idea of producing a vehicle that would meet all requirements as nearly as possible.

Mounted on each truck is a Trenton three-section tower, which enables all elevated work to be carried on with freedom and safety. Especial attention was given to the provision of space for tools and materials to meet every requirement. In the case of personal injury the emergency men are prepared to give first aid, and each truck carries a complement of stretchers, woolen blankets, rubber blankets and air pillows for the proper handling of cases requiring surgical attention.

The emergency men report to the foreman of the division where they are located, but their work is not confined to any particular area. The crew which is available nearest the source of the call is dispatched. In case of fires the load dispatcher, by means of a con-

Latest Type Tower Truck Placed in Service by Pittsburgh Railways. Gross Weight of 15,000 Lb. Is Marked on the Truck to Comply with the State Law. The Actual Gross Weight, Including Two Men, Was Found to Be 11,325 Lb.

nection to the fire alarm system, learns the location and at once notifies an emergency crew to investigate. On arriving, the emergency men telephone the load dispatcher as to the probabilities of power or traffic interruption, and remain at the scene to furnish further information, assist in rerouting of traffic, or care for any lines which may be endangered or damaged.

On holidays when traffic is heavy the regular emergency service is augumented by additional crews located at strategic points. These extra crews are composed of linemen, qualified by many years of street railway service. Line cars are usually the means of transportation for the extra service, since the regular equipment of tools will meet practically any demand.

Regular emergency service is not maintained on the interurban routes, but the residence of the men and the work schedule of these divisions is so arranged that men competent to handle high-tension lines, signals and other facilities peculiar to high speed routes are available on short notice.

The management of the Pittsburgh Railways Company has always been progressive and liberal to the extent of its resources. As a result the department of lines has been free to carry on experiments with various classes of materials and devices, and within reasonable limits to modify methods of construction in order to determine what is best adapted to the system as a whole.

Hard drawn trolley wire is standard, but on account of the increasing interest in high strength alloy wires, tests of such wires are being conducted on each division on routes where operating conditions are severe.

Rigid trolley construction prevails over the entire system, years of demonstration having shown this type to be best adapted to local conditions. Inasmuch as but few cases of crystallization are reported, it would

Left—Concrete Pole Installation at Charleroi, Pa., Pittsburgh Railways. Center—A Particularly Helpful Installation of National Trolley Guard on a Reverse Curve Crossing with the B. & O. R.R. on Second Avenue, Pittsburgh. Right—Typical Automatic Signal Installation of the Pittsburgh Railways. This Particular Installation Is on the Beachview Route

seem that possibly rigid construction is a remedy to some extent for this troublesome tendency.

Trolley and feeder construction along paved thoroughfares is supported on steel span poles. Standard poles are three section, 30 ft. in length, of extra heavy tubing and provided with a reinforcing sleeve at the ground line. The section lengths are of special proportions in order to furnish a maximum amount of space in the top section. Several sizes are used according to the requirements of single line, double line, curves or special work. All steel span poles are set 6 ft. below curb grade, in concrete, and keyed with blockstone. The rake is uniformly at the ratio of 12 in. in 24 ft.

In passing, it is perhaps not amiss to cite the advantage of utilizing trolley span poles for street lighting. A notable program of "white way" lighting has already been carried out by the city of Pittsburgh and surrounding boroughs. The Duquesne Light Company has in all cases suspended its lights from ornamental brackets attached to the tops of span poles.

Long and irregular spacing of poles is avoided as far as possible. On straight line a spacing of 100 ft. is considered the limit, and by careful survey it is generally possible to confine the spacing to this distance with a tolerance of a few feet to reach a property line. For curve and special work construction, poles are spaced and located in relation to the requirements.

On private rights-of-way, wood poles are used exclusively for supporting trolley, feeder, transmission and other lines. All wood poles are head guyed to reduce stresses at the butts, thereby very materially increasing the life of the poles. Realizing the increasing scarcity of sound, symmetrical wood poles, the corresponding increase in price, and the necessity for a substitute, several important sections of line have been reconstructed on tubular, reinforced concrete poles, such as pictured herewith.

TROLLEY WIRE HEIGHT MAINTAINED AT 20 FT.

Trolley wires are maintained at a uniform height of 20 ft. above street grade as far as possible, except where passing under bridges and viaducts. Brailing is used on both the outside and inside of all curves, enabling trolley wires to be held in rigid alignment to the curvature of the track. All branch trolley wires are dead ended after passing through frogs but all other forms of strain guying have been discarded.

All line ears are 15 in. in length, with cap and cone suspension over paved track and round top suspension over T-rail trackage. Wood strain insulators are used exclusively for all trolley spans, their reliability having been amply demonstrated. Both wood strain insulators and caps and cones are painted once annually with a special preservative.

On account of the many short radius curves, which are a product of the narrow thoroughfares, a rather large assortment of trolley frogs of different degrees is necessary. Both malleable iron and bronze frogs are in use. Malleable iron, sherardized, has been found to be very satisfactory for frogs and for solid and adjustable crossings, both from the standpoint of first cost and from service.

Feeders throughout the system are supported aërially on the span poles. On steel poles, malleable iron crossarms, of a design originated by the line department to meet the requirements for supporting heavy feeders without being unsightly in appearance, are used. Feeder pins and insulators are of special design to meet local conditions.

Where street railway tracks cross steam railroad tracks at grade a trolley guard has been erected over the trolley wires as a means of insuring a supply of power to the cars in case of dewirement. To increase the factor of safety, the zone of the guarded trolley is of ample length to cover a two-car train both on the approaching and leaving sides of the steam railroad tracks. Special pole layouts were designed to support the increased weight of the crossing guards in order that the trolley wires could be easily maintained at the proper elevation.

The Pittsburgh Railways Company has always favored electric switch throwing devices and 115 of them are in operation at the present time. Like all other pieces of apparatus containing moving parts, electric switches must be properly maintained, preferably by men understanding both the electrical and mechanical features. The department of lines follows this practice, and on one particular division where many electric switches are involved one man confines his duties solely to this work, making rounds of inspection daily with a Ford roadster equipped with delivery body for transporting tools and repair parts.

Non-clearance curves, which cannot always be avoided where double tracks are laid on narrow streets, are equipped with automatic, trolley contact, block signals of Nachod design. These signals permit single train movements only and eliminate the delays and dangers due to backing should two trains reach the curve at the same time. Train movements over single track are governed by Nachod automatic block signals of the closed circuit type, permitting following movements.

Signal apparatus is under the direct supervision of the division foreman, assisted by certain linemen familiar with the circuits.

Since the track is the other side of the street railway power circuit the bonding of track has been given special attention. To obtain the best results certain men confine their activities to bonding and are competent to apply both compressed and arc weld bonds. Maximum conductivity of joints can only be secured by careful application of the bonds and the necessary tools have been carefully selected to achieve this result. Labor saving electric motor driven tools are used for drilling, reaming and grinding.

In conclusion, permit a brief retrospect to former years, when the large electric railway systems of today were small properties, when lines were constructed and maintained by those nomadic functionaries collectively referred to as the "line gang"—may their tribe increase. For be it said to their everlasting credit, the old time "line gang" with meager equipment of tools and crude materials not only constructed and maintained creditable lines but established the basic principles upon which modern line construction is founded.

Publicity Slips Accompany Checks

THE Olean, Bradford & Salamanca Railway pays all its employees, and other creditors, by check. To emphasize the fact that the money to make these payments comes from the railway patrons, slips have recently been attached to all outgoing checks. The slip reads:

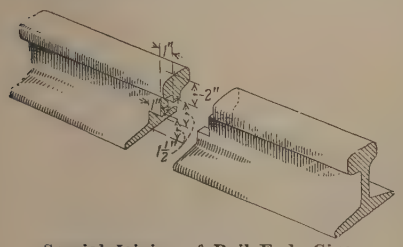
"It is the people who ride on our cars who make advertisements that are being published in the local newspaper."

Equipment Maintenance Notes

Mitered Joint in T-Rail Has Great Strength

IN AN effort to devise a rail joint of the ordinary bolted type having greater strength than the ordinary joint, the Union Street Railway, New Bedford, some time ago constructed a mitered joint for use in open track. The rail used for the experiment was 5-in. T. It was cut vertically and horizontally as shown in the accompanying sketch. The end of another rail was cut to correspond.

After thus mitering the ends of two rails, the joint plates were left entirely loose to see what strength



Special Joining of Rail Ends Gives High Strength

the joint would develop. This joint has now been under comparatively heavy traffic for two years and has stood up in excellent shape. During this entire time the joint plates have been left loose. It is felt by the railway that such joints possess much greater strength than the ordinary straight vertical joint, but that the cost of cutting is too great to make its use practicable except under unusual conditions.

Adjustable Winding Rack

THE winding of armatures is facilitated considerably in the Junction Park shops of the Beaver Valley Traction Company, New Brighton, Pa., by the use of the adjustable rack illustrated herewith. The base of the rack has four legs with cross braces of steel strap. Upon this is mounted a 4-in. steel channel with the groove fitting over the base. This channel has a groove slotted longitudinally for about half its length. On this is mounted the adjustable support for one end of the armature shaft, held by a follower and through bolt. The angle

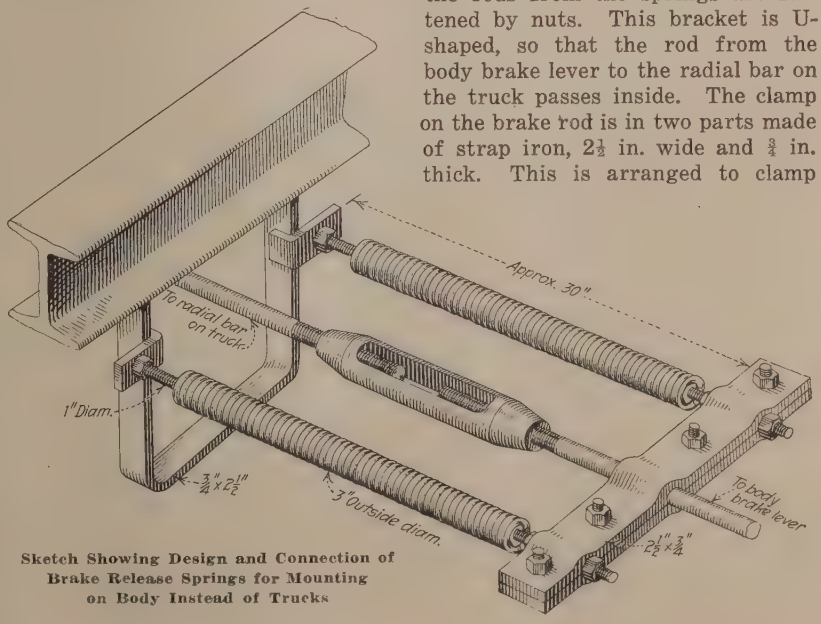
This Rack Is Adjustable for Various Lengths of Armatures

on the upright is machined with an offset so that it fits into the slot and holds the bracket in line. A slight turn on the nut releases the bracket so that it may be shifted to another position. The opposite support is fixed.

For winding compressor armatures which are too short to fit in the rack in the ordinary manner a sleeve bearing is attached to the upright and the armature shaft inserted in it.

Release Springs Connected in Body Brake Rigging

THE Philadelphia & Western Railway, Norristown, Pa., is using a special arrangement of the brake release springs on its cars.



Sketch Showing Design and Connection of Brake Release Springs for Mounting on Body Instead of Trucks

The springs are connected at one end to the rod running from the body brake lever to the radial bar on the truck. At the other end they are attached to a special support on the body underframe. The brake release springs on the trucks have been done away with, also various supporting parts, which lightens the truck considerably. At the same time the new arrangement of brake release springs insures that the shoes will remain free of the wheels and thus increase their life and reduce energy consumption.

The arrangement as shown in the accompanying illustration consists of two large tension springs. These are 3-in. outside diameter and have a nut screwed into either end, the thread on the nut being arranged so as to screw into the turns of the spring. Rods threading in these nuts at opposite ends of the springs are attached to a permanent bracket on the car body underframe and to a clamp on the rod running between the body brake lever and the radial bar of the truck. The rods used to connect the ends of the springs to their supports are 1 in. in diameter.

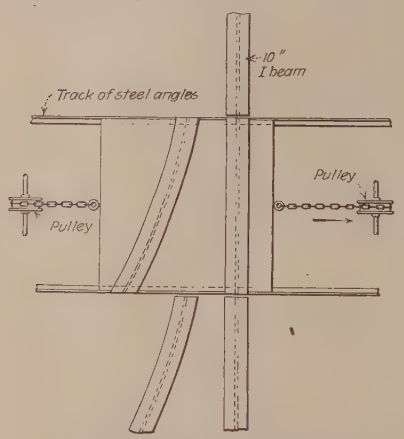
The bracket which forms the permanent attachment for the springs is made of ¾-in. x 2½-in. strap iron and has two supporting clamps to which the rods from the springs are fastened by nuts. This bracket is U-shaped, so that the rod from the body brake lever to the radial bar on the truck passes inside. The clamp on the brake rod is in two parts made of strap iron, 2½ in. wide and ¾ in. thick. This is arranged to clamp

firmly on the brake rod and also has provisions for clamping the two rods which lead to the release springs. Further fastening is also provided by nuts on the end of the rods.

By this installation the release spring equipment is placed up away from wheel wash and mud, so that its operation is not so likely to be affected by weather conditions. Strong springs can also be used and efficient release of the brakes assured. This construction has been in successful use several years.

Overhead Monorail Switch

HEAVY material is moved from place to place in the shops of the Worcester Consolidated Street Railway, Worcester, Mass., by means of an overhead monorail system. The track is made of 10-in. I-beams from which are suspended rolling chain hoists. The main track runs



The Square Frame Moves on a Track Made of Angle Irons, When This Monorail Track Switch Is Thrown

through the entire shop and branch tracks lead off to various places, such as the welding rooms, where special operations are performed. To accomplish the switching from the main track to a branch, an unusual overhead track switch is used. A gap is cut in the overhead rail sufficient to allow the insertion of a rectangular frame that carries two short pieces of 10-in. I-beam, similar to that used for the main track. One of these is straight to bridge the gap in the straight track, and alongside of it the other which is curved with the correct radius to connect the straight track with the curved track. The frame rolls transversely on a track composed of steel angles. This track is slightly depressed to lock the switch into position. The switch may be thrown from the shop floor by chains fastened to the frame and running over a pair of pulleys.

Dick Prescott Delivers Material

And Sees an Opportunity

"DICK," said Steve White, the carpenter foreman, late in the morning of Dick Prescott's second day as a carpenter's helper in the Consolidated Railway & Light Company's shop, "run over and see if old man Johnson has those vestibule belt rails ready for us. We've got to get this car out, and our time is getting pretty short."

Accordingly, Dick immediately went over to the mill. On the previous day he had seen Steve White make a rough pencil sketch and heard him tell the shop clerk to have six pieces made up in the mill in accordance with the dimensions shown. He had not, however, heard the careless boy actually transmit a verbal order to make four pieces instead of the number required. Approaching old man Johnson, who was busily engaged at the shaper, Dick asked, "Have you finished the six belt rails that were ordered yesterday?"

"Sax rails, what you mean?" queried Johnson.

"Why, George ordered six rails made yesterday for this car that has to go out in a hurry."

"Sax nothing! Dat kid only say four pieces an' I doan' mak no sax! Der's four over on dat table an' you ken tak' 'em over. Let some'on else worry!"

Well, I'm sure I heard Mr. White tell George to get six pieces made, but I'll take these right over, as there has evidently been some error."

"Er'er yes—that's ever' day in dis shop. No order, no drawin', no system, nothing! Ever'thing last minute—hurry up! Hurry up! Half d' stuff ban wrong. Believe me, I lak t' have all good lumber we spoil! Tak' 'em on over, dis shop mak' me sick!"

After delivering himself of this tirade, Johnson turned on his heel and walked away, while Dick piled the four finished rails on his arm and started back for the carpenter shop.

Steve White was again busy at his little desk, this time listing in a requisition book a long string of parts which he had discovered were out of stock.

Dick looked in the door of the office and said, "Johnson only made up four of these rails, Mr. White; I thought I heard you say yesterday that you needed six."

"What!" exclaimed White. Then turning to the boy at the time window, "George, how many of these rails did you order yesterday?"

"Why, I'm not sure, Johnson seemed to know how many to make."

"Good Lord! What's the matter with your ears? Get over there and tell Johnson to make up two more pieces right away!"

As the boy slouched out the door, White turned to Dick as though thinking aloud. "We're sure out of luck now. Can't possibly get that car out today. Suppose old Johnson has his machines set up for something else by this time."

Dick, who had been thinking rapidly, hesitated a moment and then deciding to take advantage of the opportunity, spoke up.

"Mr. White, I've done drafting work in several shops during my summer vacations and I wonder if I couldn't be of help to you right here in the office. We could set up a drawing board over there in the corner, and I could do some of this detail work of making sketches, chasing up material and other things that would give you more time in the shop."

"Well, I don't know. I've talked to the old man about putting on a man for that kind of work, but he won't listen. Says this shop has got along all right for thirty years and he don't see no reason getting loaded up with a lot of red tape now. It would sure be a big help—"

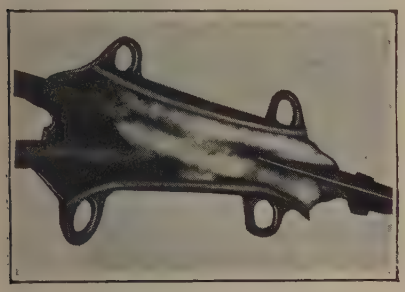
Just then the telephone interrupted and White picked up the receiver.

"That you Steve?" said Thomas Mullaney's gruff voice. "How's that car coming along? The transportation department wants to know when to send for it."

(To be continued next month)

Overhead Frogs Reclaimed by Welding

THE Springfield Street Railway has recently undertaken a program of reclaiming its overhead frogs. Investigation showed that these frogs were wearing out in the grooves rather than on the treads. Although the frogs are made of malleable iron, it was decided to try the experiment of building them up by welding. This was done with the



Worn Grooves in This Frog Were Built Up by Welding in Springfield, Mass.

ordinary arc-welding machine, after which the frog was ground smooth. A welded overhead frog is shown in the accompanying illustration. The process costs only 75 cents per frog, and experience has shown that a frog reclaimed in this way will wear as long as a new one. This cost figure includes labor and material for the shop work, but not the cost of taking down and replacing the frog on the line, as this would have to be done were a new frog used.

Making Work Easier for the Mechanic

IT IS the theory of the Holyoke Street Railway that better work is done if the job is made as easy as possible for the workman. With this idea in mind, supports have been arranged to raise motors undergoing overhauling so that they can be got at more readily. Wooden horses also are used to raise the trucks to a convenient position. This plan is feasible at Holyoke because the shop is equipped with a 10-ton Niles traveling crane. With this crane it is easy to pick up motors or trucks and place them upon the supports.

All Heavy Equipment Is Handled by a 10-Ton Crane

New Equipment Available

Earth-Boring and Pole-Setting Machine

DUE to the heavy loads which the trolley and transmission lines of electric railways bear, poles must be well set in deep, clean holes. Poles for trolley lines are frequently set at an angle which makes the hole difficult to dig by hand and the pole difficult to set. Also many poles require setting in places where the working space is limited.

In order to meet these problems, the Four-Wheel Drive Auto Company of Clintonville, Wis., is marketing an earth-boring machine which not only digs the holes but also sets the poles. A special feature of this machine is equal distribution of load and power to the four wheels of the truck. This provides the large amount of traction that is necessary to negotiate bad roads, ditches, grades, etc. The turning radius of the truck is about 25 ft. 3 in., which permits the machine to go into tight places.

This special machine digs holes in any kind of soil except solid rock, raises the pole, drops it into place and then moves to the next location in considerably less time than the hole can be dug by hand. There is also a considerable saving in the number of laborers required, since three men can handle the machine conveniently. Of the three men, one drives the truck and controls the various gear shifts of the machine, one operates the earth-boring machine, and one ground man assists the machine operator.

At the front end, next to the clutch, is a set of gears known as the Debooster gears. Under ordinary operating conditions these gears are not used, the power going direct to the transmission. When the truck is required to operate under subnormal conditions, however, by engaging these gears the entire gear ratio is lowered, giving the truck a low gear ratio of 72.9 to 1. These gears are not used when the earth-boring machine is in operation, as the rotation of the auger would be too slow for satisfactory results. The only place they are used is in moving the truck over bad places.

Back of this gear assembly the transmission is located. This unit is of the sliding jaw clutch type, having gears in mesh at all times. Four sets of gears are provided in the transmission, giving three speeds forward and one reverse to both the truck and the earth-boring machine. When power is applied to the truck the power is transmitted to a subtransmission by means of a 5-in. silent chain. At this point the power is divided equally between the front and rear axles through the center differential.

In the rear of the transmission is located the power take-off, transmitting the power to the earth-boring machine. Within this power take-off is a double jaw clutch sliding which moves on the square of the transmission shaft. When the power take-off is disengaged or in neutral position, the front end of the jaw clutch is fully engaged with the silent chain upper sprocket, so that when any gear shift is made the transmission main shaft will turn the silent chain, thereby applying the power to front and rear axles. When the earth-boring machine power take-off is en-

At Left, Digging a Hole. Each Load of Dirt Brought Up by the Auger Is Thrown to One Side. In Center, One Man Guides the Pole as It Is Raised. At Right, After the Pole Is Raised It Is Set in Position by the Machine

gaged, the sliding jaw clutch is pushed away from the silent chain sprocket and the other side is engaged to the shaft of the boring machine. The power is therefore transmitted from the square of the transmission shaft through the sliding clutch to the earth-boring machine. The silent chain sprocket remains stationary.

Just back of the tower brace bracket in the rear of the main shaft are two hand levers. One of these levers controls the operation of the winch drum. To engage the winch drum with the main shaft, this lever is pulled out and pushed in until the lever drops in place back of the locking block. The left-hand lever controls the operation of the sluing gear or the turning of the boring machine upon the large bull gear. This hand lever is connected with the main shaft, and the turntable can be swung to the side of the truck.

A ratchet hand lever located opposite the winch drum controls the brake on the winch drum. All levers, including the levers controlling the auger, are located on the right side of the truck within easy reach of the boring machine operator.

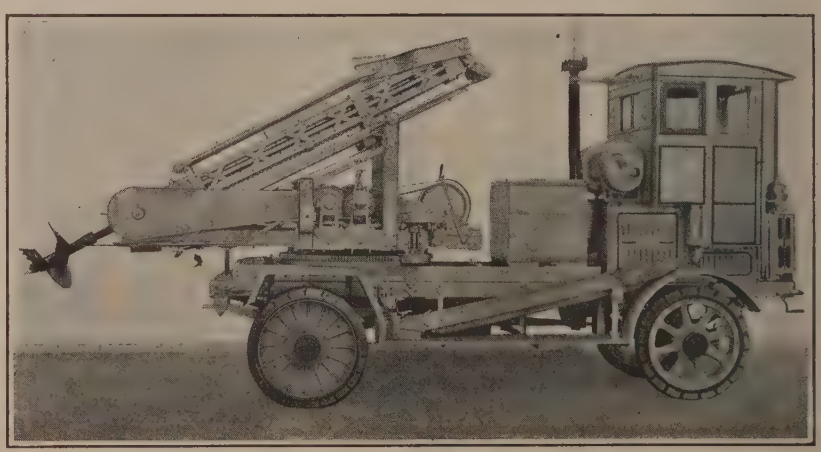
After the truck has been spotted, the emergency brake set and the wheels properly chucked, the power is applied to the earth-boring machine by shifting the central control lever out of neutral and into a position which engages the earth-boring machine power take-off with the transmission.

The signal for first speed is given, the clutch is disengaged and the speed control lever is put in the low-speed position and the clutch pedal is released. This engages the earth-boring machine power take-off with the first speed of the transmission. The engine is then accelerated to the speed called for. The speed of the earth-boring machine is controlled by the acceleration of the engine. By keeping one foot on the accelerator, the driver has full control of the engine at all times.

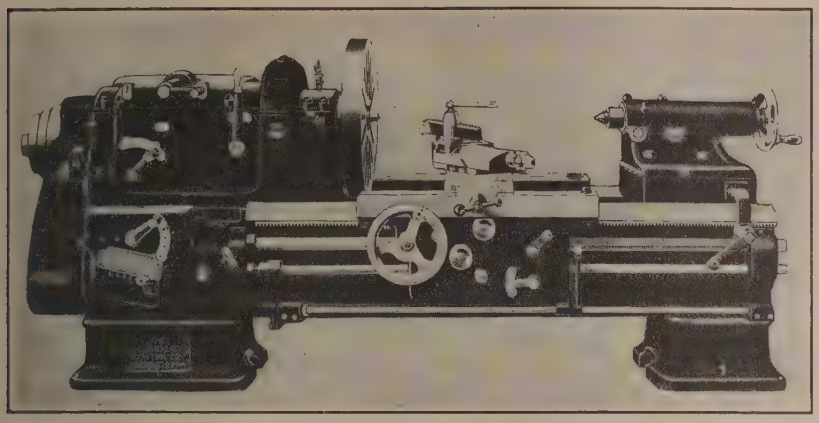
To dig a hole the driver is given the signal for second speed and the auger is raised from the ground by a slight jerk of the auger feed clutch lever, thereby starting the auger spinning. The driver is then given the signal for full acceleration of the engine. The auger is lowered and slowly fed into the ground by gradually lowering it with slight jerks on the feed clutch lever. When the auger is buried into the ground, the drive clutch lever is pushed in and the auger is raised above the ground by pushing the feed clutch lever. The driver is then given the signal for third or high speed with full acceleration of the engine. The dirt which has accumulated on the auger is thus discharged. This operation is continued until the auger shaft has traveled its limit or until the hole has been dug the required depth.

While the operator is digging a hole, the extra man releases the winch drum brake and pulls out the winch cable. The cable is fastened to the pole at as near a balancing point as possible. After the hole has been dug, the chuck blocks are removed from the rear wheels and the truck is driven forward until the winch boom is even with the side of the hole. The height of the boom allows raising of pole clear of the ground, with at least 1 ft. clearance between the boom sheave and the pole.

The pole is then slowly pulled toward the digger and up toward the boom. If there are wires above, the pole must be in a parallel line with the wires. The pole is pulled up slowly, with a man at the butt to guide it through the wires and bring it over the hole. When the bottom of the pole is clear a signal is given to stop, apply the brake, reverse speed and release the brake. Then, with slow acceleration of the engine, the pole is lowered into the hole.



New Earth-Boring and Pole-Setting Machine with Four-Wheel Drive



Single-Pulley, Belt-Drive-Geared Head Lathe

New Geared Head Lathe

A SINGLE-PULLEY, belt-driven lathe with twelve speeds and thirty-two changes of feeds has just been placed on the market by the Cincinnati Lathe & Tool Company, Cincinnati, Ohio. The advantages of the new machine as set forth by the manufacturer are as follows:

The twelve speeds can be made in an equal number of seconds and with but thirteen gears. Not more than one pair of gears are in mesh for any of the speeds, all of the gearing is contained in one solid housing. The gear velocity is low and as a result the lathe is very quiet running. Shifting levers are located so as to insure ample clearance and make it impossible to cramp or pinch the hand.

The interior of the headstocks can be inspected through an opening in the top of the cover without the necessity of removing the entire cover from the head. The splash system of lubrication in the head sends oil to all the bearings, and an indicator shows the amount of oil in the base of the head. A settling basin and a drain are provided for renewing the oil.

Provision is made for mounting the driving motor, either on the head or underneath the overhang of the head near the floor line. A low mounting of the motor brings the center of the motor near the center of gravitation of the lathe, and thus prevents vibration. Both of the drives are self-contained so that the lathe can be removed without inconvenience. These lathes can be supplied in sizes from 16 in. to 30 in.

New Tower Truck for Baltimore

THE accompanying illustration shows a tower truck which has been furnished recently to the United Railways of Baltimore, Md., by the Hampstead Mill & Body Works, Inc., Hampstead, Md. The body is mounted on a 3½-ton White truck with pole derrick, Trenton tower and winch. The sides are housed at the bottom and are divided into tool boxes of different sizes. Provision is made for carrying long tools by compartments which extend entirely through the truck body. The top has detachable bows with kahki top and curtains.

Tower Truck with New Features

Gun for Spray Painting

A GUN for spray painting that has many new features has been developed by the De Vilbiss Manufacturing Company, Toledo, Ohio. Special attention has been given to simplifying construction and reducing the number of parts and wearing points. The new gun is without yokes, links, pins, or push rods, and has only one pivot bearing. All moving parts are inclosed.

All nozzle parts are self-centering with the fluid tip and air cap positively held concentric. This makes it impossible for the nozzle to get out of alignment when parts are interchanged. The fluid tip is made of nickel alloy steel hardened, heat treated and ground. The body and other parts are made of special high strength, heat-treated aluminum alloy drop forgings. This reduces the weight of the complete unit to 10¼ oz.

New Gun for Spray Painting

A rotary air cap is provided which gives a wide fan spray when placed in a horizontal or vertical position and a round concentrated spray when placed in any intermediate position. The parts which require cleaning are all confined to a quick detachable spray head. This can be taken apart, cleaned and reassembled in less than two minutes. Special attention has been given toward providing accurate balance so that the gun will rest easily in the workman's hand, and the free finger action makes operation easy and non-tiring.

This new gun is designated as type A. Its wide range of work is claimed to result in improved spray painting.

American Association News

Publicity Men Gather at St. Louis

IF THE directors of the state committees on public utility information entertained any doubt as to the American Electric Railway Association being in hearty accord with their efforts and willing to go to any limits to help them, they were removed at the publicity meeting on the day following the midyear gathering in St. Louis.

Directors representing more than twenty states were present. When James P. Barnes, chairman of the committee on co-operation on state and sectional associations, whose chief duty is to see that electric railway executives co-operate with the directors, and W. H. Sawyer, chairman of the committee on publicity, stood up and said that they would go the limit for the directors, they were cheered heartily.

Mr. Barnes explained that it did not seem feasible to send out questionnaires or circular letters to the industry generally, for the reason that such general ammunition seldom brought about good results and also that a very large majority of the executives are co-operating with the state committees.

"However, if you have a hard nut to crack, just let me know, and I will get on the job," Mr. Barnes said in closing.

The meeting was attended by about fifty publicity men, all of whom were given an opportunity to talk before the meeting closed. Mr. Sawyer presided.

The outstanding feature of the session was the urging of publicity men to make greater use of the radio. J. C. McQuiston of the Westinghouse Company, who organized the first radio program that company ever had and has been making up programs ever since, said that there was a vast undeveloped field for good publicity material over the radio. The hardest thing in the world, he said, is to get good copy for the program. Mr. Barnes spoke similarly regarding the use of the radio and said that it has been proving very helpful in Kentucky.

B. J. Mullaney of Chicago, who is known as one of the pioneers of the state committee movement, spoke enthusiastically regarding the plan of the association for reaching the individual member. He said he believed that this plan came nearer reaching the grass roots of the situation than that of any of the national utility associations.

Mr. Sawyer and E. F. Wickwire, chairman of the committee on co-operation of manufacturers, called especial attention to current work of the Advertising Section and told how in their opinion the directors could be of service in disseminating advertising material through encouraging electric railway executives to use it.

E. B. Atchley, Northern Ohio Traction & Light Company, made a rousing speech in which he pointed out that many executives were weakening their positions by not doing persistent advertising and publicity work. He said that many executives thought the proper way to do advertising was to begin taking full pages a week or so before they wanted to accomplish something. Failing to obtain the desired results, they blame it on the advertising.

These remarks by Mr. Atchley moved E. E. Soules, Illinois Traction System, to add a few words in a similar vein. He told specifically of one case that he had in mind where an executive who has done no advertising is planning a thirty-day campaign in the hopes of getting a new franchise.

One thing that was especially noticeable was that the directors of public utility information committees voiced their feeling that the railway men were now really appreciating the publicity and advertising end of their business, and were as a whole really doing good work. At previous meetings of this kind the railway man has always been criticised for lack of publicity interest.

Included among those present were State Directors Benjamin E. Ling of Ohio, John C. Mellett of Indiana, George McQuaid of Texas, Horace M. Davis of Nebraska, Joe Carmichael of Iowa, J. B. Sheridan of Missouri, George E. Lewis of Colorado, Earle W. Hodges of Little Rock, Ark., and Samuel T. MacQuarrie of Massachusetts.

Welding Committee's Request Was Approved

E. M. T. RYDER has checked up with President Budd as to the action taken by the executive committee in St. Louis on March 3 on the request of the welding committee for release of the funds originally appropriated for use in building a rotary test machine, to be used in making tests of another nature. There was some difference of opinion as to what action was taken. The JOURNAL printed on page 377 of the March 8 issue the statement that the executive committee did not approve the request of the welding committee. In its original report of the meeting the JOURNAL had recorded the action as approval, but this was changed by one of the officers of the association who understood the action to have been disapproval. This confusion undoubtedly came from the jocular manner in which the motion was finally put. Harry Reid said at the end of the discussion:

"Mr. President, I would like to move that your ideas be embodied in a motion which I would be glad to present."

This came about because two other motions had been made which did not seem to meet the situation, and yet it was evident that the committee desired to carry out the wishes of the president, who had previously said:

"I am perfectly willing that the committee should use the funds that it has for the other purpose, whatever it may want to do with them, but I would like to foreclose any demand for any further money from the association for construction of a machine, if we grant the request that these funds be used as the committee may see fit in its experiments." Later Mr. Budd expressed himself thus:

"I don't seek to minimize the importance of the committee's work, but I will not, as long as I am at the head of the association, acquiesce in the appropriation of any more money for building a machine. . . . I don't believe in an industry such as ours, if you cannot get from actual operating experience in our big companies, under the direction of this committee, sufficient funds to make the demonstrations in practical operation, under practical operating conditions, that you are going to get anywhere by designing a machine to duplicate operating conditions. . . ."

Hearing on Section 15-A

ON MARCH 19 some sixty representatives of interurban railways appeared before the Interstate Commerce Commission in Washington for a hearing to determine whether Section 15-A of the transportation act shall be interpreted to include electric interurban railways. A report of the principal features of the case made by the railway men will be published next week.

News of Other Associations

Illinois Utilities Joint Meeting

THE fourth joint convention of the Illinois Electric Railways Association, the Illinois Gas Association and the Illinois State Electric Association will be held at the Hotel Sherman, Chicago, on March 26 and 27. Joint sessions will be held in the mornings, the meeting on Wednesday being given over to reports of committees and district chairmen, while on Thursday there will be a symposium on "What the National Associations Are Doing" by Alexander Forward, M. H. Aylesworth, Britton I. Budd and A. C. Hall.

At the electric railway session on Wednesday afternoon papers will be presented on "Educating the Public," by Luke Grant; "Education of Employees," by C. B. Goodsell; and a report of the A.E.R.A. committee on co-operation with state and sectional associations by G. W. Welsh.

At the Thursday afternoon session papers will be presented on "Bus Transportation," by Garrett Seeley; "Light-Weight Double-Truck Cars," by H. H. Adams; "Some Problems Involved in the Construction and Maintenance of Electric Railway Tracks," by S. Clay Baker.

At the banquet to be held on Wednesday evening the principal speaker will be Floyd W. Parsons.

New England Club Program

THE twenty-fourth annual meeting and banquet of the New England Street Railway Club will be held at the Copley Plaza Hotel, Boston, on March 27. The annual meeting, with election of officers, will be at 3 o'clock. There will be a reception at 6 o'clock, followed by the dinner. The Hon. Robert M. Washburn will be toastmaster, and the speakers will be United States Senator George H. Moses of New Hampshire, Gov. Channing H. Cox of Massachusetts, Mayor James M. Curley of Boston and the Rev. William Porter Niles.

The News of the Industry

Bus Talk in Cleveland

Two Sets of Interests Active—Cleveland Railway States Its Attitude —Hearing Set for April 10

Bus interests are threatening the Cleveland Railway with competition. A company, known as the Cleveland People's Motor Bus Corporation, has already requested the Ohio Public Utilities Commission to grant it a certificate of convenience and necessity for the operation of 175 double-deck buses paralleling fourteen of the main routes of the railway.

This company says it desires to operate its buses on a six to eight-minute headway between 6 a.m. and midnight, and that it will provide seats for each passenger, charging a 10-cent fare. It also insists that it will not really be in competition with the railway, but will give a parlor car service, something between that supplied by the taxicab and the street car. Most of its business, so the representatives of the company say, will come from people who now drive their own cars to business. A hearing on this company's application will take place on April 10 before the State Public Utilities Commission at Columbus.

Representatives of another company, backed by interests controlling the Red Top Taxicab Company, say they are prepared to provide bus service in Cleveland, if the Cleveland Railway is not disposed to give this sort of service.

Under the Tayler service-at-cost franchise in Cleveland, the railway and the car riders are partners. Because of this fact, the City Council takes the position that if there is any bus service in Cleveland the Cleveland Railway should give it. John J. Stanley, president of the Cleveland Railway, says his company is willing to operate buses providing Cleveland people desire this service and the City Council authorizes the company to give it.

At a hearing before the committees of the Council on public utilities and street railway Mr. Stanley asked the representatives of the Cleveland People's Motor Bus Company whether they would be willing to accept a bus franchise containing terms similar to the Tayler franchise, which limits the return to stockholders to 6 per cent a year. The representatives of the Motor Bus Company present said they were unable to answer this question in the absence of financial backers, and the hearing was adjourned for a fortnight.

Members of City Council and others versed in the law are of the opinion that the State Public Utilities Commission has no jurisdiction over Cleveland streets and cannot allow any bus company to operate in Cleveland without a franchise from the Cleveland City Council, because Cleveland is a charter city functioning under the home rule provision in the state constitution. If this view is upheld by the State Public Utilities Commission on April 10, or by the courts, as appears likely, it is believed that if buses are operated in Cleveland, they will be controlled and operated under the direction of the Cleveland Railway.

Nine-Cent Fare in Cincinnati

Fares in Cincinnati will be increased from 8½ to 9 cents beginning April 1. The Cincinnati Traction Company has posted notices in its cars that such increase will be put into effect under the terms of the service-at-cost franchise ordinance. W. Jerome Kuertz, Director of Street Railways, recently called attention to the fact that there was a large deficit for the current quarter in the company's receipts and that the city franchise tax would not be earned in full during the quarter. Under the ordinance the fare is to be raised ½ cent at the beginning of the next quarter when such conditions exist.

The increase of ½ cent in the rate of fare will affect only about 65 per cent of the riders, as 35 per cent now pay the 9-cent cash fare. Under the new rate no tickets will be sold at 8½ cents. Every one will pay 9 cents a ride, whether he tenders cash or buys tickets.

It will be necessary for the city and the street railway to agree upon a modified franchise and for the stockholders of the traction company and the street railway to approve the terms of the agreement between them before the new financial arrangements intended to be carried out by the Cincinnati Street Railway and the Cincinnati Traction Company can be put into force. This will take several weeks' time at the very least. For this reason the corporate changes could not be carried out in time to stay the fare advance.

Commission Against Five-Cent Fare for Trenton

The State Board of Public Utility Commissioners has informed Mayor Frederick W. Donnelly of Trenton, N. J., that the present 8-cent fare of the Trenton & Mercer County Traction Corporation is not excessive. The board disagrees with the Mayor in his stand that a 5-cent fare should be fixed. In reply to the suggestion of the Mayor that a lower fare would probably result in an increase in the number of car riders, the commissioners state that an attempt to force a reduction in rate without evidence of an excessive return should not be made unless it appeared clear at the present time that the company could bring about such reduction without creating a deficit which later might have to be made up by a higher fare.

Franchise in Columbus

Twenty-five-Year Grant for Ohio City Now Up for Discussion by City and Railway

Surrender of the perpetual franchises of the Columbus Railway, Power & Light Company, Columbus, Ohio, at the expiration of a ten-year period, immediate extension of two lines in the city and a yearly extension of 1 mile during a ten-year period, are the principal features of a proposed franchise ordinance introduced at the meeting of the City Council on March 17. A round table discussion between members of the City Council and officials of the company was set for March 21.

The franchise as proposed would be effective for a period of twenty-five years. It provides also that the company shall spend $200,000 this year for new equipment and that there shall be no change in the present fare, namely, 6 cents cash, or five tickets for 25 cents and free transfers.

The perpetual franchise clause says:

> The rights, privileges and grants herein made are so made with the express understanding and on the condition that the acceptance hereof by the Columbus Railway, Power & Light Company shall operate as a surrender by said company, its successors and assigns, of all claims or rights to any and all perpetual franchises in any street or streets in the City of Columbus, all such claims to terminate with the expiration of the franchise herein granted.

As to railway extensions, it is provided "that either the city or the company may propose extensions, and Council at its discretion may require reasonable extensions operated by the company under safeguards considered reasonable to the company and the city."

The immediate extension of two car lines, as provided in the franchise, does not apply to this 10-mile provision. One of the car lines, the Summit Street, will be extended 1 mile within the next six months, while the Mound Street line will go to the city corporation line. Provision is made that Indianola Avenue, on which the former line is to run, shall be widened to 50 ft. or more from curb to curb within six months.

In addition to these extensions it is also proposed that the company shall change the narrow gage tracks of part of the North High Street line to the corporation line to permit other cars to operate over the tracks. This improvement is to be made one year after the passage by the City Council of an ordinance directing it, the proposed franchise holds.

Arrangements have been made, if the franchise is adopted, whereby railway service to Clintonville, a suburb, will be extended for the distance of 1 mile. This, together with the West Broad Street extension, will make 2 miles of additional line available immediately, provided Council takes early action on the measure.

Monorail Plan Rejected at Detroit

The Detroit Rapid Transit Commission has had under consideration the petition of the Michigan Elevated Railway relative to considering that company's equipment in connection with rapid transit for the city and reported that it does not feel warranted in considering for Detroit any type of transportation not fully developed and proven in operation. The observations of the commission as set forth by Sidney D. Waldon, chairman, include the statement that in considering the question of rapid transit for Detroit the commission has dealt with the subject from the viewpoint of the requirements of the city in 1950, with a probable population of 2,500,000, as well as with the needs of the present city with its present population. The capacity for mass transportation, practicability of operation, economy of construction and general desirability have been the governing considerations of the commission's study.

The commission arrived at this conclusion after a careful study of all types of elevated railways in operation here and in Europe. Among those types the monorail lines, existing and proposed, were included. There are two monorail lines in operation—one in Ireland, of a type where the weight for the car and passengers is balanced on either side of the rail, the car just clearing the ground, and one in Germany, connecting the industrial towns of Barmen and Elberfeld, of the free suspended type, the structure carrying the car being at a height sufficiently above the ground to clear the traffic. This system has been in operation since 1901 and repeated attempts have been made to secure its adoption in Berlin without success.

It is cited that there are no monorailways in operation in the United States.

The commission has made surface rapid transit the keynote of its plan. By so doing, it will effect a saving of millions of dollars in future construction and at the same time offer a means of handling and controlling the motor traffic expansion of the future at a reasonable cost, it is believed by the commission. It considers this feature too valuable in the interest of the community to justify abandoning it for any other type or for an undemonstrated possibility.

Both Trolley and Bus Needed in Newark

Rapid, safe, sanitary and comfortable mass transportation in the morning and the evening rush hours is necessary in Newark. In order to meet that need the city requires the full resources of both the trolley and the bus. These are among the main findings contained in the report just presented by a committee of the local Chamber of Commerce appointed to inquire into the matter.

The committee holds that the elimination of the independent bus owner from the transportation field is neither necessary nor expedient. The independent operator, according to the committee, has a distinct field, not only to fill certain present demands but also to develop new routes and territory.

The conclusion of the committee is that co-ordinated service should be committed to the Public Service Railway, but that co-ordinated service applies only to those routes on which the bus and the trolley are in competition. The committee says that "healthy competition along salutary lines should be fostered and encouraged." The committee expresses the belief that the adoption of the principles which it lays down will mean to Newark and its sister communities "a 5-cent fare, no monopoly and growing transportation as Newark grows."

Extension of Franchise Sought in Springfield, Ill.

A new franchise for the Springfield Consolidated Railway, Springfield, Ill., is up for consideration. Proposals and counter-proposals have been made. The present franchise does not expire for four years but the company had given notice to the city through A. D. Mackie, general manager, that it would be unable to go ahead with its share of the public improvement program unless the franchise was lengthened. The company is paying for its share of the improvements which run into thousands of dollars by the sale of bonds. Under the present franchise, soon to expire, the company has found it difficult to carry out necessary financing to the best advantage.

In its appeal the company requested that the sections of the old ordinance providing that the company pave between its tracks and that the company pay a franchise tax to the city, be done away with. These requests were supported by the contention that these costs, which run into high figures, are in the last analysis met by the passenger and not by the company.

A number of sections of the company's proposal refer to buses as well as street cars, and the ordinance provides that a blanket franchise shall be voted to the company covering all the streets within the present limits of the city of Springfield, or within the boundary lines as they may be extended from time to time during the twenty years, subject to the selection of specific streets from time to time by the Council and the company.

The counter-proposal of the city was drawn by City Attorney Sampson. It denies the plea of the company that the paying charges section be discarded and drops the special tax only in part.

Among the provisions of the ordinance suggested in behalf of the city are:

1. That the company shall pay for all paving between its tracks.

2. That the company shall pay a 4 per cent tax on its gross earnings for ten years and a 2 per cent tax for the next ten years. In the old ordinance under which the company is now operating it paid 2 per cent for ten years and 4 for the next ten.

3. That buses be used on certain streets to give additional service to thickly populated sections of the city.

4. That the city reserve to itself the right to purchase the street railway at any time during the life of the franchise at a price to be determined upon by arbitration.

Board Backs Mayor's Anti-jitney Ruling

A definite stand to support Mayor Edwin F. Leonard of Springfield, Mass., in his decision to rule independently operated buses from the streets of the city after May 1 was taken by the transportation board March 18 following a hearing before which a committee of the Springfield Bus Owners' Association appeared.

The decision was made on the ground that the street railway is a necessity and that it is unfair to allow any independent transportation group to take away any of the patronage from an essential service.

Richard J. Talbot, counsel for the Bus Owners' Association, was told by Alderman John D. Stuart, chairman of the transportation board, that if the bus owners secured signatures of half the voters in the city giving it as their opinion that the buses should be retained, the board will again consider the matter of continuing their licenses. Mr. Talbot says that an effort will be made to comply with that condition.

Upholds Fight Against Unionizing Pacific Electric Employees

The United States Supreme Court at Washington, D. C., in a decision on March 3 upheld the fight against unionizing the Pacific Electric Railway, Los Angeles, Cal. This ruling puts a final and permanent quietus on the efforts of professional organizers to unionize the employees of this system. M. E. Montgomery and J. A. Farquharson of the Brotherhood of Locomotive Engineers and Brotherhood of Railway Trainmen had petitioned for a writ of review to reconsider the decision of the Circuit Court of Appeals, rendered in Los Angeles on Nov. 13 last. That decision was referred to in the ELECTRIC RAILWAY JOURNAL, issue of Dec. 1, 1923. This final decision enjoins the two brotherhoods and their officers and agents and all others acting with them from making any attempt to cause the Pacific Electric employees to join such brotherhoods and through them deal with the Pacific Electric Railway.

The numerous court actions grew out of the strike of Pacific Electric trainmen in 1918. At that time the company obtained a temporary injunction restraining the brotherhoods in their efforts to unionize the company's employees. This injunction was granted the United States District Court of Los Angeles. The next day the strike collapsed.

The brotherhoods later appealed to the United States District Court of Appeal at San Francisco and this court sustained the order of the lower court granting the temporary injunction. The case then came up for trial on the issues involved before United States Judge Radkin, who was sitting as a visiting judge in the Los Angeles Federal court in the early part of 1923. The case being decided in favor of the Pacific Electric Railway, the brotherhoods appealed to the District Court of Appeal, which sustained the lower court a second time. The brotherhoods then appealed to the United States Supreme Court for a writ of review.

Franchise Agreement in Birmingham

At a conference between the City Commissioners of Birmingham, Ala., and the receivers of the Birmingham Railway, Light & Power Company, held on March 15, the receivers agreed to pay the city the sum of $35,000 for a thirty-year franchise over 140 blocks of city streets scattered over the city. Thy represent about 10 per cent of the trackage. The remaining 90 per cent was originally granted in perpetuity. In discussing the franchises City Commissioner Harrison indicated that with these franchises for short stretches of track expiring in periods of from four to six years it was in the interest of the city to accept any reasonable offer, particularly as the question was tied in with the lifting of the receivership and the franchises for the short stretches had no inherent value except in so far as they were joined with the perpetual grant so as to facilitate the operation of the system as a unit.

Seattle Employees Gain Support of Committee in Income Fight

In their fight against paying the federal income tax, the Seattle Municipal Railway employees have won the support of the city utilities committee of the City Council of Seattle, Wash. The committee recommended that the corporation counsel be asked to contest the ruling, which, in effect, declares that the railway workers are not exempt from the income tax, as are other city employees. The theory of the ruling is that the railway is not a branch of the city government, but a business venture of the city. A federal court injunction may be procured against the tax collector.

Traffic Experiments in Milwaukee

A co-ordinated effort is being made to solve the traffic problem in the downtown section of the city complicated by the addition of the city buses of the Milwaukee Electric Railway & Light Company to the present traffic. The safety commission with the co-operation and permission of the railway has proposed that two experiments be made to fix the best practice. One plan of the bus zoning experiment, to be given a two weeks' trial, will involve the marking off of spaces in each block of Grand Avenue sidewalks in the rear of the street car safety zones where the buses may drive up and stop flush with the walk and load and unload passengers. No other vehicles will be allowed to occupy these zones which will act as platforms. The other plan which will also be given a two weeks' trial will be to have the buses stop on the car tracks loading and unloading passengers from the same safety zones that cars now use.

Air Pressure Tank Order Expected in Indiana

An order is in preparation requiring interurban and street railways in Indiana to show on each car the date of safety inspection of air pressure tanks on cars and otherwise providing greater protection for passengers from possible explosions of such tanks, due to overpressure. The order will be promulgated by the Public Service Commission. It is understood that the commission will require that the tanks be equipped with safety "blow-offs" and be reguarly inspected. On March 4 the commission held a conference with representatives of railways looking toward such regulation. A committee was formed consisting of G. R. Green, master mechanic of the Chicago, South Bend & Northern Indiana Traction Company, and others. This body has drafted recommendations for the order. David E. Matthews, chief of the inspection division of the commission, is preparing the recommendations, together with suggestions of the division for presentation to the commission, which then will issue an order.

Bill Assessing Property for "L" Removal Signed

The two Burchill bills authorizing New York City to remove the elevated structure on Sixth Avenue were signed on March 18 by Governor Smith. Under the new law the railroad will be compensated by the city for the destruction of its property. An additional assessment against the property to be benefited by the improvement will be made by the city.

One of the bills provides for the removal of the spur from Fifty-third to Fifty-ninth Street and the other for the removal of the rest of the Sixth Avenue elevated line from Fifty-third Street to the Battery, and the construction of a subway to replace it, including, of course, the necessary connection with existing and projected subway lines.

Julius Miller, president of the Borough of Manhattan, who sponsored the removal, has announced that he will submit to the Board of Estimate plans for the demolition of the spur. No opposition is expected, as the members of the board are understood to be united on the desirability of its removal.

Bus Operation in Port Jervis Ready When Authorized

Plans for bus operation in connection with the railway lines of the Port Jervis Traction Company, Port Jervis, N. Y., were outlined at a hearing on the application of the Port Jervis Transit Company, Inc., subsidiary of the railway, for such operation before the Public Service Commission, March 17.

The company wants a permit to run two twenty-one-passenger Locomobile "Road King" buses on a one-hour headway over certain streets of Port Jervis. The desired route runs practically north and south through the city. The railway lines run approximately east and west. Transfer from bus to trolley and vice versa will be free. The fare will be 5 cents for each of two zones. A 10-cent through fare will be charged with ten tickets for 75 cents. The buses will serve a district heretofore without public transportation facilities. No action has as yet been taken by the commission.

Extensive Traffic Survey Planned for Los Angeles

Following appeals from the Los Angeles Traffic Commission to take early action in the matter of definite relief to traffic congestion in the downtown district of the city, the City Council proposes to approve an appropriation of $40,000 to carry out an extensive transportation survey of Los Angeles. The survey is to be conducted under the supervision of F. A. Lorentz, chief engineer of the Board of Public Utilities, and it is planned to engage Major R. F. Kelker of Chicago to direct the survey. It was urged that the appropriation be raised to $100,000, with the request that Los Angeles County contribute half of this amount, as the survey to accomplish the desired results must extend out into the county highways.

With the rapid automotive growth it is considered necessary that a comprehensive subway system be planned and constructed and street cars be removed from the street surface.

It is contended by the City Council that a bond issue of $125,000,000 would be required to finance the subway system, but the bonding capacity of the city, it is stated, will not allow such bond issue to be voted by the people. On the other hand, it has been suggested that private capital be induced to construct a rapid transit system.

The Pacific Electric Lines took the first step to relieve traffic congestion in Los Angeles when on Feb. 21, 1924, preliminary work was undertaken on its Hollywood-Glendale subway.

Bus Suggested for Shore Service

Philander Betts, chief inspector of the Board of Public Utility Commissioners of New Jersey, recently appear before the Chambers of Commerce of Cape May and Atlantic City and submitted a report on the electric railway situation on the shore in which he urged bus service on the shore road between Absecon and Pleasantville and the elimination of one-man cars on the suburban line. He urged the Atlantic City & Suburban Company to abandon duplicate service across the meadows and submit a report to the commission by April 1. The expert for the railway also advocated the elimination of the combination baggage and passenger cars now in use on the Atlantic City & Shore Fast Line.

Neutral Arbitrator Selected

Lewis C. Parker of Westfield, Mass., has been selected as neutral arbitrator in the dispute between the Worcester Consolidated and Springfield Street Railway Companies and the carmen's union. The carmen are asking for an eight-hour day, a six-day week and an increase in pay of about 20 cents an hour; also a reduction in the maximum spread for combination runs from fourteen to eleven hours. The company offers to continue the present maximum wage of 58 cents, but wants to eliminate certain bonuses, or if the bonuses be not eliminated, to decrease the hourly wage by 5 cents. Bentley W. Warren represents the companies and James H. Vahey the carmen in the proceedings.

Higher Fare Increases Revenue by $40,000

Increase to an 8-cent fare with tickets selling at four for 30 cents brought in approximately $40,000 added revenue for the Community Traction Company, Toledo, Ohio, during February, according to the report of Commissioner W. E. Cann to the board of control at the monthly meeting.

Passenger traffic was scarcely affected at all by the fare increase. The average daily business was 182,092 revenue passengers in February, as compared with 178,574 in January and 182,305 a year ago. This was 8.67 passengers per car-mile, which is the highest since last March. Total revenue passengers numbered 5,280,660 for the month. As a result of operations there was added to the stabilizing fund in February $18,322, as compared with $2,757 for the same month last year. A credit of $15,000 for extraordinary maintenance was made in addition to the $40,000 usual allowance. Gross revenue amounted to $364,719, as compared with $312,946 last year. Operating expense of $179,000 represents an increase of 2.067 cents per car-mile, which is due almost entirely to the higher wage scale now in effect. Ratio of operating expense to gross income is 69.551 per cent. Operation of the bus feeder lines showed a loss of $860.65 for the month.

One Bid on Bus Lines.—Only one bid has been received by the City Commission of Astoria, Ore., on bus lines to supplant the Pacific Power & Light Company's system, which is to suspend operations. It was submitted by S. W. Lovell, Astoria, and W. E. Young, Portland, under the name of the Astoria Transit Company. The bidder asks for a twenty-year franchise, agrees to give a fifteen-minute service with not less than six Mack buses, charge a fare not to exceed 10 cents and pay 2 per cent of the gross receipts to the city. The bid is being examined by the city manager and attorney.

Appears to Contest Lower Fare.—William H. Maltbie, representing the United Railways & Electric Company, Baltimore, recently appeared before the Senate committee on corporations at Annapolis in opposition to the passage of a bill offered in the Maryland General Assembly to force the company to reduce fares in Baltimore from 7 to 5 cents. Interesting data were contained in a chart submitted to the committee by Mr. Maltbie showing how the 7-cent fare is expended.

Bus Service in Summer Months.—The Hartford & Springfield Street Railway has projected a limousine bus service between Springfield, Mass., and Hartford, Conn., in the summer months, in addition to the service now being maintained, which includes buses from Springfield to Windsor Locks and electric cars for the rest of the route. It is proposed to fix the fare for the round trip at $1.25. Occasional excursions from Hartford to more distant points, to include Greenfield and Brattleboro, are contemplated.

Bulletin Tells Everything.—The Pittsburgh Railways, Pittsburgh, Pa., has issued a time-table guide and general information bulletin for its patrons. The booklet contains a description of the various points of interest in the city and the routes to arrive at such places, a little account on parking regulations, something about what happens to your fare after you give it to the company and some things the company is actually doing to improve service. A map is included showing the territory served by the Pittsburgh Railways.

Electrification Planned.—The Reading Company (Philadelphia & Reading Railway) Philadelphia, Pa., has announced intentions of electrifying its line between St. Clair and Frackville, Pa., at an estimated cost of $1,500,000. Preliminary plans and surveys are now under way for this improvement, which will include automatic substations, line equipment, etc.

Wants to Discontinue Transfer Use.—The Puget Sound International Railway & Power Company, Everett, Wash., has asked permission from the State Department of Public Works to discontinue the issuance of transfers on its bus system, which superseded the company's railway system in Everett. The company has asked permission to try for ninety days, beginning April 1, operating without transfers, alleging that the present fare of 5 cents will no longer permit issuing transfers.

Two Arbiters Named.—Representative Peter F. Tague of Massachusetts has been named to represent the union trainmen of the Capital Traction Company, Washington, D. C., on the arbitration board to determine whether wages of motormen, conductors and shopmen should be increased at this time. The Capital Traction Company announced that its arbitrator will be Stanton C. Peelle, member of a law firm. These two men will select a third arbitrator to represent the public.

New Buses in Hartford.—The Connecticut Company has purchased two new buses to put in operation on the Maple Avenue route, Hartford. The new buses will seat twenty-nine people. Buses at present in use on Maple Avenue will be transfered to the High Street line.

Fares Lowered.—Reduced fares for school children between the ages of five and twelve went into effect on the cars of the Olean, Bradford and Salamanca Railway, in Salamanca, N. Y., on March 8. Tickets are now sold in sets of five for 25 cents, and these tickets are good in the city limits of Olean, Bradford and Salamanca, but not on interurban cars.

Franchises Advertised.—D. P. Abercrombie, receiver for the Connecticut Valley Street Railway properties, has advertised franchises, tracks and all buildings and equipment to be sold at private sale, and invites offers up to March 28. The sales are to be subject to approval by the Massachusetts Supreme Court.

Winter Hard on Railways.—The United Electric Railways, Providence, R. I., has estimated that the recent record March gale will cost between $20,000 and $30,000. Transportation is now entirely restored within the city limits and outside the limits. The Union Street Railway, New Bedford, Mass., has just recovered from the effect of a severe blizzard which crippled the interurban line to Fall River. Nearly one-quarter of the company's Much of the company's overhead work was blown down.

Trolley Likely to Go.—The Hornell Traction Company, Hornell, N. Y., has decided not to keep the line in operation more than two months longer. In the meantime, a plan is to be submitted to the stockholders to sell the equipment and put in operation a fleet of buses under a franchise from the city.

Railway Complains of Bus.—In letters signed by Col. Albert T. Perkins, manager for Receiver Rolla Wells of the United Railways, St. Louis, Mo., addressed to the St. Louis Board of Public Service protest is raised against the operations of the People's Motorbus Company in that city. The railway complains that the operation of buses on Lindell Boulevard interferes with cars and other traffic and that the buses are a menace to life and property, particularly east of Twelfth Boulevard, the congested section of the city.

Franchise Deal Confirmed.—The private bills committee of the Legislature on March 13 confirmed an agreement between Ottawa city and the Ottawa Electric Railway, Ottawa, Ont., renewing the franchise of the company for thirty years with a 5-cent fare for that time. There is a provision that at the end of each five years the city may take over the railway at its arbitrated value. One point debated was whether the railway should be exempt from taxation for school purposes. The bill, however, carried without amendment.

Radio Talks Reprinted.—The radio talks on "The Boston Elevated—As You Should Understand It" by Edward Dana, general manager of the property, have been reproduced in pamphlet form. This nineteen-page pamphlet is illustrated. Portions of Mr. Dana's talks were published in the ELECTRIC RAILWAY JOURNAL, issue of Jan. 12, 1924.

Upholds One-Man Car.—The use of one-man cars effecting lower operating costs in the Commonwealth has been commended by the commissioners in the annual report of the Massachusetts Department of Public Utilities. The statement is made that the use of these cars has been the deciding factor in enabling the companies to render service that otherwise could not have been furnished at all and to render more frequent service where the service formerly given was infrequent and inadequate.

Same Insignia on Buses.—The buses of the Los Angeles Railway will hereafter be inscribed with "Los Angeles Railway" spelled out in full length along the sides. They were formerly monogrammed "L. A. Ry. Co." It was decided that since the buses were a part of the railway they should be marked exactly like the street cars.

Financial and Corporate

Youngstown Lost $198,678 in 1923

Gross Revenue Rises 14.5 per Cent, but Mileage Increases 18.8 per Cent—Deficit Reaches $1,039,794

The 1923 report of the Youngstown Municipal Railway, issued through Harry Engle, Street Railway Commissioner, indicates that the deficit in the fare stabilizing fund has increased to $1,039,794.

FINANCIAL AND SERVICE STATEMENT OF THE YOUNGSTOWN MUNICIPAL RAILWAY

Gross Earnings

1919	$1,418,217
1920	1,907,252
1921	1,463,352
1922	1,491,095
1923	1,707,530

Car-Miles of Service

Year	Trolleys	Bus	Total
1919	3,358,834	.....	3,358,834
1920	3,459,510	.....	3,459,510
1921	3,579,532	.....	3,579,532
1922	4,010,067	112,901	4,122,968
1923	3,979,806	919,557	4,899,364

Passengers Carried

1919	24,500,000
1920	28,493,713
1921	21,703,998
1922	26,337,168
1923	28,807,622

Capital Value

Jan. 16, 1919	$3,900,000
Dec. 31, 1919	4,384,484
Dec. 31, 1920	4,384,603
Dec. 31, 1921	4,406,071
Dec. 31, 1922	4,510,994
Dec. 31, 1923	4,640,298

Damages

1919	$79,359
1920	162,658
1921	142,169
1922	154,942
1923	135,440

Taxes

1919	$86,477.32 paid in 1920
1920	93,588.03 paid in 1921
1921	83,897.23 paid in 1922
1922	96,710.46 paid in 1923
1923	97,735.30 paid in 1924

Stabilizing Fund Deficit

Jan. 15, 1919, cash in bank	$100,000
Dec. 31, 1919, cash in bank	20,946
Dec. 31, 1920, deficit	19,837
Dec. 31, 1921, deficit	524,140
Dec. 31, 1922, deficit	841,115
Dec. 31, 1923, deficit	1,039,794

Losses in Operation

1919	$76,153
1920	40,684
1921	504,304
1922	316,974
1923	198,679
Total	$1,139,794

Recapitulation for Year

Gross revenue from all sources		$1,707,542
Operation	$1,144,858	
Maintenance	359,478	1,504,336
Revenue before taxes		203,205
Taxes		97,735
Revenue before payment of rent		105,470
Rent		304,149
Deficit after payment of rent		198,678

Gross increased from $1,491,095 to $1,707,530, or 14.5 per cent, but mileage increased from 4,122,968 to 4,899,364 vehicle-miles, or 18.8 per cent. Almost all of this increase was in bus-miles. The actual increase in motor-bus miles was 808,656, but the total increase (776,396 vehicle-miles) was somewhat less owing to the replacement of two car routes by bus routes.

The first buses were installed on Dec. 1, 1922, on two new routes. On March 18, 1923, the Indianola and South bus lines were added to cover more ground than the replaced Woodland and Williamson car routes. Later in the year more bus routes were added, making a total of seven. At present, the commissioner has ten new buses for installation as soon as the jitneys are finally ejected.

If allowance is made for the increase in vehicle-miles the earnings per mile in 1922 were on the order of 36 cents, whereas in 1923 the average was only 34.8 cents, against a cost of service of 39.1 cents.

During all of 1922 and up to April 1, 1923, inclusive, the fare was 9 cents cash, 8⅓ cents tickets, 1 cent transfer and $1.25 weekly pass. At the suggestion of Commissioner Engle the company installed a schedule of 7 cents cash, 6⅔ cents tickets and 1 cent transfer on April 2, 1923. Revenues decreased and after ten weeks the company went to a scale of 8 cents cash, 7 1/7 cents ticket and 1 cent transfer. This produced some improvement, but still left the revenue per vehicle-mile below the figure of 1922.

The figures for the past five years as presented in the report to City Council are contained in the accompanying table.

$2,436,238 Net Income for Atlanta Company

No separate statement of earnings of the railway department is contained in the report of the Georgia Railway & Power Company, Atlanta, for 1923. Operating revenue of the entire system was $16,006,928 in 1923, compared with $14,449,497 in 1922. The net income for 1923 before depreciation and dividends was $2,436,238, compared with $1,917,043 for 1922. On Dec. 31, 1923, the total mileage of street railway tracks (on a single-track basis) owned, or leased and controlled and operated by the company, exclusive of the street railway mileage in Gainesville, was 244 miles. During the year 1923 the company placed an order for twenty city type electric railway double-end prepayment passenger cars, with seating capacity of forty-eight passengers each, at an aggregate cost of $274,637. As of the date of the report, twelve of these cars had been delivered and it was expected that the other eight will probably be delivered within the next few weeks.

During 1923 the company transported on its city and suburban system 95,357,117 passengers as against 92,172,664 passengers in 1922. In addition, it transported 634,014 passengers on the Stone Mountain line in 1923 as compared to 557,274 in 1922. The Atlanta Northern Railway, which is the interurban line between Atlanta and Marietta, transported 1,218,697 passengers in 1923 as compared to 1,131,278 passengers in 1922.

$2,131,164 Net at Milwaukee

Operating revenues of the railway department of the Milwaukee Electric Railway & Light Company for the year ended Dec. 31, 1923, amounted to $10,559,581, an increase of 8.61 per cent over 1922. The percentages of operating revenues of the various utilities appropriated for maintenance and depreciation of physical property were:

	Per Cent
Railway	22.30
Electric light and power	12.75
Heating	16.64

Net income available for the payment of dividends was $2,131,164. Capital expenditures during the year amounted to $5,844,745, as follows:

Railway utility	$1,699,442
Electric power and heating utility	2,982,190
Common and miscellaneous	1,163,112

During the year $243,854 worth of property was withdrawn from service.

The company has successfully continued to obtain a good share of its capital requirements from the sale of preferred stock to investors in the communities in which the company operates. It now has approximately 10,000 preferred shareholders.

INCOME ACCOUNT OF THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY FOR THE YEAR 1923

Operating revenues		$22,206,800
Operating expenses:		
Ordinary operating expenses	$14,534,908	
Depreciation (reserve credit)	1,521,338	
Taxes	1,567,091	
Total operating expenses		17,623,337
Net operating revenues		$4,583,463
Non-operating revenues		274,141
Gross income		$4,857,604
Interest charges:		
Interest on funded and unfunded debt	$2,299,183	
Interest on depreciation reserve balances	383,932	
Interest on other reserve balances	43,325	
Total interest charges		2,726,440
Net income		$2,131,164

The directors authorized the sale of $1,000,000 of 6½ per cent ten-year gold notes, Series D, dated Aug. 1, 1923, maturing on Aug. 1, 1933. The notes are being sold through the securities department of the company for cash at par. Up to Dec. 31, 1923, a total par amount of $122,500 had been issued and sold.

The revenue passengers carried increased from 144,238,122 in 1922 to 153,626,868 in 1923. The company very frankly says that a good share of this increase is due to the company's foresight in establishing up-to-date bus service.

STATISTICAL DATA OF THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY

	1923	1922
Miles of track owned	413.14	409.66
Miles of track leased	1.56	1.56
Miles of track operated	388.99	385.94
Revenue passengers carried	153,626,868	144,238,122
Transfer passengers carried	54,238,201	54,198,925
Per cent transfer to revenue passengers	35.31	37.58
Receipts per revenue passenger	$0.0664	$0.0652
Number of passenger cars owned	850	850
Number of passenger motor buses owned	93	76

New Jersey Railway Will Benefit by Refinancing

Thomas N. McCarter, president of the Public Service Corporation of New Jersey, in referring to the plan for refinancing which was mentioned briefly in ELECTRIC RAILWAY JOURNAL for March 13, says that with the adoption of the plan the holders of the securities of the underlying companies will clearly benefit to a very marked degree since the development and upbuilding of their properties will thus be assured.

With respect to the Public Service Railway he says the position of that company and the holders of its securities will be greatly strengthened because the corporation itself, as the owner of all the capital stock of the railway, will be placed in a position, as the result of the adoption of the plan, to finance the railway's capital requirements until such time as the credit of the railway will enable that company to stand upon its own feet in this regard. He says that as a matter of fact the railway's capital requirements are comparatively small and should easily be provided for in the manner indicated. The officers of the company consider this feature of the plan of great importance as it promises to the public more dependable and adequate service and to the holders of railway securities sounder credit and enhancement of value.

In short, as has been indicated previously, the plan is designed to furnish the vast sums of new money required by the company for the adequate performance of its functions.

In connection with the plan the corporation has arranged to issue 200,000 more shares of no par value common stock, of which 100,000 is to be issued at once and the remainder later on. Stockholders of record of March 21, 1924, will have the privilege of subscribing to the new stock at $44 a share for each nine shares now held, either common or preferred. For each one share now subscribed for of the first 100,000 shares, the subscriber will have the option of subscribing for an additional one share of the second 100,000 shares on the same basis as the first 100,000 shares. There are now outstanding 600,000 shares of common stock, 215,086 shares of 8 per cent cumulative preferred stock and 87,200 shares of 7 per cent cumulative preferred stock.

Reported Kansas Power & Light Includes McKinley Interest

The Topeka Railway, Topeka Edison Company, Wichita Railway & Light Company and the Atchison Light & Power Company, all in Kansas, are to be taken over by the Kansas Power & Light Company. The new company has an estimated authorized capital of $11,250,000, divided as follows: 50,000 shares of preferred stock, par $100 a share; 75,000 shares of no-par stock with an estimated value of $50 a share; 25,000 shares of no-par stock with an estimated value of $100 a share. The directors of the new corporation include A. M. Patten, T. F. Doran, Clayton Kline, A. H. Purdy, W. D. Cole, A. W. Freeman, K. H. Losey, G. W. Thompson, and G. W. Miller. The company has applied to the Public Utilities Commission for permission to issue $5,413,000 in bonds for refunding and other purposes.

Denver Tramway Offers to Extend Bonds

The Denver Tramway, Denver, Col., has offered to extend further the bonds due on April 1, 1924, for three years with tax-free convenants and present existing liens, with interest at 6 per cent. The plan has the approval of the receiver and authority of the United States District Court for Colorado.

On the $2,000,000 Denver City Tramway first mortgage, extended 6s, the company reserves the right to redeem the whole issue at 101 and interest upon any interest date upon thirty days notice. On the $741,000 Denver Tramway Power Company first mortgage improvement extended 6s the receiver has been authorized to deposit $50,000 with the International Trust Company, Denver, to be used to redeem the extended bonds at 105, as drawn by lot. The extension is asked because the fare to be charged by the company is a matter for court consideration and the reorganization has been postponed. The company with the court approval reserves the right to withdraw this privilege on or before May 1, 1924.

$51,761,348 Value Accepted for St. Louis Property

Receiver Rolla Wells and the board of the United Railways, St. Louis, are said to have decided to accept the valuation of $51,761,348 placed upon the company's physical property by the Missouri Public Service Commission on June 4, last, and to drop the appeals against that decision now pending in the St. Louis and Cole County Circuit Courts. The decision is expected to aid materially the reorganization of the company.

The company had contended for a valuation of $70,000,000 while the city of St. Louis through special counsellor Henry S. Caulfield at one time contended for a valuation as low as $29,805,975. The last arguments on the valuation were made before the state commission in February.

While this valuation of $51,761,348 covers amply the present bonded debt of the company, it would appear to leave little for the $16,383,000 of 5 per cent cumulative preferred stock outstanding, though the additions to the property value since 1919 may make provision for several millions of this stock, it is stated.

On Saturday, March 15, arguments were heard before Former Supreme Judge Fred L. Williams, temporary special master, in St. Louis in the foreclosure suit of the St. Louis & Suburban Railway bondholders against the United Railways. The bondholders are seeking to have the St. Louis & Suburban property segregated from the remainder of the United Railways. The St. Louis & Suburban System was taken over by the United Railways in 1906.

The Suburban bondholders opposed the application of Receiver Rolla Wells for permission to spend $1,065,000 for new equipment and trackage extensions. Judge Williams finally took the matter under advisement after two hours of arguments by counsel for the St. Louis & Suburban Railway bondholders, Receiver Wells and the United Railways.

The receiver desires to spend $1,050,000 in constructing 100 new side-door-exit cars and $15,000 for double-tracking the St. Charles line from St. John's station to Woodson Road.

Conspectus of Indexes for March, 1924

Compiled for Publication in this Paper by

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Worcester, Mass.

	Latest	Month Ago	Year Ago	Since War High	Since War Low
Street Railway Fares* 1913 = 4.84	Mar. 1924 **6.93**	Feb. 1924 **6.93**	Mar. 1923 **6.89**	May 1921 **7.24**	May 1923 **6.88**
Street Railway Materials* 1913 = 100	Feb. 1924 **163**	Jan. 1924 **159**	Feb. 1923 **174**	Sept. 1920 **247**	Sept. 1921 **156**
Street Railway Wages* 1913 = 100	Mar. 1924 **219**	Feb. 1924 **219**	Mar. 1923 **207**	Sept. 1920 **232**	Apr. 1923 **207**
Steel—Unfilled Orders (Million Tons) 1913 = 5.91	Feb. 29 1924 **4.91**	Jan. 31 1924 **4.80**	Feb. 28 1923 **7.28**	July 31 1920 **11.12**	Feb. 28 1922 **4.14**
U.S. Bank Clearings Outside N. Y. City (Billions)	Feb. 1924 **14.71**	Jan. 1924 **16.14**	Feb. 1923 **13.71**	Mar. 1920 **18.54**	Feb. 1922 **10.65**
Business Failures Number	Feb. 1924 **1,578**	Jan. 1924 **2,258**	Feb. 1923 **1,563**	Jan. 1924 **2,258**	Sept. 1923 **1,280**
Business Failures Liabilities (millions)	Feb. 1924 **73.75**	Jan. 1924 **100.1**	Feb. 1923 **38.15**	Jan. 1924 **109.1**	Sept. 1923 **27.50**

	Latest	Month Ago	Year Ago	Since War High	Since War Low
Eng. News-Record Construction costs 1913 = 100	Mar. 1924 **224.7**	Feb 1924 **220.3**	Mar. 1923 **205.2**	June 1920 **273.8**	Mar. 1922 **162.0**
U.S. Bur. Lab. Stat. Wholesale Commodities 1913 = 100	Feb. 1924 **152**	Jan. 1924 **151**	Feb. 1923 **157**	May 1920 **247**	Jan. 1922 **138**
Bradstreet's Wholesale Commodities 1913=9.21	Mar. 1 1924 **12.80**	Feb. 1 1924 **13 20**	Mar. 1 1923 **13.93**	Feb. 1 1920 **20.87**	June 1 1921 **10.62**
Dun's Wholesale Commodities 1913 = 120.9	Mar. 1 1924 **190.7**	Feb. 1 1924 **191.1**	Mar. 1 1923 **191.2**	May 1 1920 **263.3**	July 1 1921 **159.8**
U.S. Bur. Lab. Stat. Retail food 1913 = 100	Feb. 1924 **147**	Jan. 1924 **149**	Feb. 1923 **142**	June 1920 **219**	Mar. 1922 **139**
Nat. Ind. Conf. Bd. Cost of living 1914 = 100	Feb. 1924 **163.9**	Jan. 1924 **164.6**	Feb. 1923 **157.5**	July 1920 **204.5**	Aug. 1922 **154.5**

*The three index numbers marked with an asterisk are computed by Mr. Richey, as follows: Fares index is average street railway fare in all United States cities with a population of 50,000 or over except New York City, and weighted according to population.

Street Railway Materials index is relative average price of materials (including fuel) used in street railway operation and maintenance, weighted according to average use of such materials. Wages index is relative average maximum hourly wage of motormen and conductors on 105 street and interurban railways in the United States, operating more than 100 passenger cars each, and weighted according to number of cars.

Indiana Interurban Has Net Income of $73,336

The net income of the Union Traction Company of Indiana for 1923 shows a surplus of $73,336 compared with a surplus of $210,163 in 1922, a decrease of $136,827. Differences in the treatment of depreciation charges for 1923 and 1922 account partly for this decrease. Computation of 1923 depreciation on the 1922 basis would increase the 1923 net income to $129,453. Financial conditions compelled the passing of sinking fund payments during the year. The deduction of 1923 sinking fund charges would make the balance for the year $4,936.

STATEMENT OF EARNINGS OF THE UNION TRACTION COMPANY OF INDIANA

	1923	1922
Revenue from transportation	$3,745,715	
Revenue other than from operation	144,974	
Total operating revenue	$3,890,689	$3,835,747
Total operating expenses	2,647,123	2,459,744
Net operating revenue	$1,243,566	$1,376,003
Taxes	257,409	264,000
Net revenue less taxes	$986,156	$1,112,003
Other income	30,998	15,337
Gross income	$1,017,155	$1,127,340
Bond and other interest, etc.	943,819	917,176
Net income	$73,336	$210,164

In the operating expenses for the year are included $534,896 for maintenance of way and structures and $320,058 for maintenance of car equipment, making the total sum charged in these directions for maintenance of the property $854,954. This sum equals 21.98 per cent of the gross operating revenue for the year, equivalent to $2,056 per mile of single main track operated, exclusive of city tracks of other companies at Indianapolis, Logansport and Wabash. The 1922 figures for the same purposes were $787,709, equal to 20.54 per cent of gross operating revenue, or $1,893 per mile of single main track operated.

During the year $323,158 was expended for additions and betterments to the company's property and $66,199 was expended for extensions and betterments to the property of the Traction Light & Power Company, owned by the company. The 1922 figures for like purposes were $257,055 and $25,295. There was also included in the expenditures of 1923 the net sum of $32,330 representing additions to property of the Traction Land Company, owned by the Union Traction Company and used to help finance the purchase of real estate required for company purposes.

One of the principal expenditures for additions was for the purchase of twenty-three safety cars, financed in part by an issue of $63,720 car trust notes payable serially during a three-year period, of which $17,700 was paid in 1923. The system comprises 453 miles of track.

Discontinuance Asked. — The Public Service Railway has asked permission of the Board of Public Utility Commissioners to discontinue railway service from Gloucester to Fairview, N. J. If the application is granted the company will remove the tracks and increase bus service between the two towns.

Auction Sales in New York.—At the public auction rooms of A. H. Muller & Sons there were no sales of electric railway securities this week.

$2,500,000 Issue Offered.—E. H. Rollins & Sons, New York, are members of a syndicate which is offering for subscription at 99½ and interest to yield 6.05 per cent $2,500,000 of Key System Transit Company 6 per cent first mortgage gold bonds, Series A. The proceeds from the sale of the bonds will be used to reimburse the treasury of the company for capital expenditures already made and to pay for the cost of additions and betterments to its plant and equipment.

Directors Chosen. — Directors were chosen at the recent meeting of the stockholders of the New York State Railways in Rochester for the Rochester Railways Co-ordinated Bus Lines., Inc., as follows: Daniel M. Beach, Albert H. Harris, Willis A. Matson, Alfred H. Smith, and James F. Hamilton. This subsidiary operates the trackless trolley line and Greece bus route in Rochester.

Prior Preferred Dividend Passed.—Directors of the Market Street Railway, San Francisco, voted on March 14 to omit the 1½ per cent, quarterly dividends on the prior preference stock. It is understood that the decision was based on the opinion that the payment would be unwise in view of the recent large refunding operations and the retirement of more than $500,000 of funded debt.

New Data for Sale.—The receiver for the defunct Pennsylvania & Ohio Traction Company, Ashtabula, Ohio, recently announced that another effort would be made to dispose of the property at public auction on April 7, at the courthouse in Jefferson. A sale was advertised for Jan. 28, but no bids were made. If no bids are made at the coming sale it is reported the receiver will ask for a reappraisal.

Interurban Line Sold. — Representatives of the security holders bought the Cleveland, Southwestern & Columbus Railway, Cleveland, Ohio, at foreclosure sale on March 14 for $4,605,000. The property includes 202 miles of track. The company has outstanding $4,236,000 of common stock and $2,413,000 of 5 per cent cumulative preferred stock. The property was put into receivership on Jan. 20, 1922, on petition of the General Electric Company.

Canadian Road Floats Issue in London.—The British Columbia Electric Railway, Vancouver, B. C., is reported to be floating an issue of £750,000 of 5 per cent debentures in the London market. They are redeemable in 1934 at 95.

Wants Company to Operate.—Just as soon as the Colorado Springs & Interurban Railway, Colorado Springs, Col., announced the plan proposing the discontinuance of its service from the Springs to Roswell, a suburb, the suburbanites drew up a petition asking the Public Utilities Commission to force the company to operate its electric cars.

Applies for Abandonment.—Competition of buses was blamed for the decision of the DeKalb-Sycamore & Interurban Traction Company of Illinois to cease operations. An application for permission to quit business was filed with the Illinois Commerce Commission at Springfield on March 14. The interurban operates between DeKalb and Sycamore.

Appraisers Named.—G. E. Scott and M. G. Irvin, Norwalk, and A. V. Brown, Sandusky, have been named appraisers of the Norwalk-Shelby Railway, now in the hands of receivers and about to be ordered sold to satisfy mortgages.

Reorganization Effective.—Following the retirement of Ives & Davidson, New York City, as operating managers of the Mauch Chunk & Lehighton Transit Company, Mauch Chunk, Pa., a reorganization took place on March 10. A new board of directors was elected by the stockholders. The officers chosen are: President, V. M. Walff; vice-president and general manager, H. T. Ely; treasurer, G. H. Myers, and secretary, H. O. Probst. The company owns and operates the electric railway in Mauch Chunk, East Mauch Chunk and Upper Mauch Chunk also an interurban line to Lehighton.

Seeks Partial Abandonment.—The Union Traction Company, Santa Cruz, Cal., has applied to the Railroad Commission for authority to abandon operations upon Soquel, formerly Minnesota Avenue, from Front Street to Pacific Avenue, and those portions of its system extending respectively to La Veaga Park, Seabright and Capitola.

Gold Bonds Offered.—A syndicate including A. C. Allyn & Company, Inc., New York, is offering at 96¾ and accrued interest to yield about 6.80 per cent $880,000 of the North Carolina Public Service Company, Inc., first lien and refunding mortgage 6½ per cent gold bonds. The bonds, known as Series "A," are dated Feb. 1, 1924, and are due Feb. 1, 1944. This company is a consolidation of properties as noted in the ELECTRIC RAILWAY JOURNAL for March 8.

Gold Bonds Offered.—Howe, Snow & Bertles, New York, are offering at 95 and interest to yield 6.90 per cent, $800,000 of first lien and refunding 6½ per cent gold bonds of the Central Power & Light Company, known as the "1952" Series. The bonds are dated Sept. 1, 1922, and are due Sept. 1, 1952. The company operates directly or through its subsidiaries thirty-four central electric power stations as well as doing a gas, water, railway or ice business in fifty cities and towns in eleven different groups. The proceeds from this additional offering will be used to cover part of the expenditure for improvements on the Texas Central Power group and other properties located in Texas.

Separate Company for Railway at Ottumwa. — The Ottumwa Traction Company, Ottumwa, Iowa, incorporated in Delaware in January, has taken over the railway properties formerly included in the system of the Ottumwa Railway & Light Company. This is a change in the interest of simplification of intercorporate relations and does not involve any change with respect to the control of the properties by the Byllesby interests and the Northern States Power Company.

Personal Items

Fred C. Marston Appointed B.-M. T. Secretary

Fred C. Marston, who recently resigned as a vice-president of the Irving Bank-Columbia Trust Company, has been elected secretary and treasurer of the Brooklyn-Manhattan Transit Corporation. Mr. Marston is the first man to hold this post since the company was reorganized from the old Brooklyn Rapid Transit, the new corporation having up to this time had no secretary and treasurer.

Mr. Marston joined the original Columbia Trust Company before its amalgamation with the Irving Bank, in 1905. He became assistant secretary in 1908 and rose from then on until he became vice president, a post which he held until his resignation.

S. E. Boney Made Director of Carolina Information Bureau

S. E. Boney, Philadelphia, has been named by the executive committee of the newly organized North and South Carolina Public Utility Information Bureau as the director of the bureau. He has had an experience of eighteen years in the newspaper field. Mr. Boney has served with the Union (S. C.) *Times*, the Laurens (S. C.) *Advertiser* and the *News and Courier* of Charleston, S. C. For the past ten years he has been with the *Public Ledger*, Philadelphia. His most recent position was city editor of both the *Public Ledger* and the *Evening Public Ledger*. Mr. Boney is a native of South Carolina, in which state he is widely acquainted.

Ben S. Allen Appointed to Key System Transit Company

Ben S. Allen has been made manager of the recently created public relations department of the Key System Transit Company, Oakland, Cal. Mr. Allen took his degree in history at Stanford in 1907. He served on several San Francisco newspapers as reporter until 1908, when he joined the San Francisco bureau of the Associated Press. He was transferred East, and after serving for a short time in New York and Washington offices of the Associated Press he was sent to the London bureau, where he acted as outside man for seven years. During the first three years of the World War Mr. Allen covered many of the big stories coming under the jurisdiction of the London office. He was one of the seven men invited to Herbert Hoover's office for the purpose of forming the Commission for Relief of Belgium, and thereafter, as a volunteer, directed the publicity of that great relief organization. When the United States entered the war Mr. Allen returned to this country with Mr. Hoover and, with the creation of the Food Administration, he became director of its educational division. He was also publicity advisor of the Fuel Administration and the War Trade Board. Returning to California at the close of the war, he became the publisher of the Sacramento *Union*, a position he held for two years. He then started a national educational campaign designed to inform consumers about the operations of the California farmers' co-operative marketing associations. Later he reentered the newspaper field as publisher of the *California Farmer*, one of the leading farm journals of the Pacific Coast.

C. C. Coates Promoted

C. C. Coates was recently promoted from assistant railway superintendent to the position of railway superintendent of the Pacific Northwest Traction Company and Puget Sound International Railway & Power Company, in Everett, Wash. He entered the employ of Stone & Webster in 1907, in the sales department of the Whatcom County Railway & Light Company at Bellingham. He was later transferred to the accounting department, continuing in that work until July, 1917, when he was appointed to the position of assistant railway superintendent in Everett.

C. C. Coates

A. A. Wilson, formerly general agent of the Chicago, Milwaukee & St. Paul Railroad at Denver, has been appointed traffic manager of the Salt Lake & Utah Railroad, with headquarters at Salt Lake City, Utah. Mr. Wilson succeeds A. V. Kipp, who resigned last October to become assistant general freight agent of the Oregon Short Line Railroad. Mr. Wilson has been identified with the Chicago, Milwaukee & St. Paul Railroad for the past twenty-seven years and has worked in various capacities in the traffic department. He began his railroad career as a telegraph operator and worked up to division freight and passenger agent in Iowa. He was later promoted to assistant general freight agent at Chicago and then to general agent of the line at Denver.

H. E. Blain Political Organizer

H. E. Blain, assistant managing director of London Underground Railways and the London General Omnibus Company, has been appointed chief agent of the British Conservative (or Unionist as it is sometimes still called) Organization, in succession to Admiral Sir W. Hall, retired. Mr. Blain, though a conservative, has never actively concerned himself in political affairs, but he has a great reputation as an organizer, and it is as an organizer that he is expected to prove of greatest value to the Conservative party. Years ago he was principal traffic assistant on the Liverpool Corporation Tramways. In 1903 he became tramway manager to West Ham Corporation. Ten years later he left West Ham and joined the London Underground Railway and bus combine as purchasing agent. In 1914 he became operating manager, and in 1921 assistant managing director. Mr. Blain was president of the Municipal Tramways Association in 1910-11. He achieved independent note as the founder and first chairman of the London Safety First Council and founder and vice-president of the British Industrial Safety First Association. To this movement for the prevention of accidents he has devoted his energies with great success. In fact, he may be said to have called it into being in England, and now it is an elaborate organization. The Conservative party evidently considers that in him it has found the man it wants. He is not tied up with a political past, and is free to devote his organizing abilities to the improvement of the party electoral machine.

New Appointments at Pittsburgh

Several new appointments in the newly reorganized Pittsburgh Railways, Pittsburgh, Pa., have been announced, as follows:

C. C. Gillette has been appointed traffic agent.

J. E. Davis has been appointed special investigator.

F. R. Cogswell has been appointed director of traffic promotion.

J. B. Donley has been appointed director of public relations.

All these officers have their headquarters in the Central Office Building, in Pittsburgh. The appointment became effective March 1.

A. W. Leonard, president of the Puget Sound Power & Light Company, Seattle, Wash., has been elected president of three of the subsidiary companies of the corporation: The Puget Sound Electric Railway, operating the Seattle-Tacoma electric interurban; the Tacoma Railway & Power Company, operating the Tacoma street railway system, and the Pacific Northwest Traction Company, operating the Mount Vernon-Bellingham interurban. Mr. Leonard succeeds Frederick D. Pratt in the presidency of the three companies, while Mr. Pratt becomes chairman of the board of directors in each instance. The company does most of the commercial electric lighting and power business in the Puget Sound District and Western Washington and substantially all the electric street and interurban business there except in Seattle.

P.R.T. Official Changes

Changes have recently been announced in the designation of the personnel of the Philadelphia Rapid Transit Company as follows: R. F. Tyson has been advanced from operating manager of the elevated railway to vice-president in charge of operation. G. C. Haney succeeds Mr. Tyson as manager of the elevated. H. C. Heaton has replaced George B. Taylor as engineer of way. B. J. Yungbluth will continue as supervisor of materials and supplies but will take on new duties as assistant vice-president of finance and accounting.

Fred P. Snyder, for several years in charge of the shops of the Oakwood Street Railway, Dayton, Ohio, has been appointed superintendent of transportation and equipment.

William A. Jackson, who has been at the head of the legal department and legislative counsel of the Milwaukee Electric Railway & Light Company, Milwaukee, Wis., for the last nine years, has been elected a vice-president of the company, according to S. B. Way, vice-president and general manager of the company. Before going to the Milwaukee company, Mr. Jackson was associated with the North American Company.

Frederick L. Farr, formerly specialist in public utility securities for Moody's Investors Service, has joined the staff of Stevens & Wood, Inc., who finance and manage utility and industrial properties.

Obituary

R. K. Willman, formerly president of the Citizens' State bank and a director of the Union Traction Company of Indiana, Anderson, died recently at Hartford City, Ind.

E. F. J. Gaynor, auditor of the Interborough Rapid Transit Company, New York, N. Y., is dead. He had been connected with the company and its predecessors more than forty-six years. In 1903 when the Manhattan Railway lines were leased by the Interborough Rapid Transit Company Mr. Gaynor was appointed auditor of the latter company. Prior to that he had been auditor of the Manhattan Railway.

Five Cents in Kenmore

Under an agreement between officials of the Northern Ohio Traction & Light Company, Akron, and the city of Kenmore a 5-cent fare with penny transfers will become effective in Kenmore. Formerly Kenmore had a 5-cent rate with free transfers, as did Akron under the terms of the old Akron franchise, which expired Feb. 1. Since that time the fare between Kenmore and Akron has been 7 cents.

Though under a separate city government, N. O. T. Officials desired to give the community the same fare rate as prevails in Akron.

The new rate will be effective as soon as permission to put it in effect is received from the State Public Utilities Commission.

Manufactures and the Markets

News of and for Manufacturers—Market and Trade Conditions
A Department Open to Railways and Manufacturers
for Discussion of Manufacturing and Sales Matters

Railways Buy Many Fageols

During the first sixty days of 1924 the Fageol Motors Company received orders from electric railways in the United States equal to more than half of the entire purchases of Fageols by railways in 1923. Most of these orders were placed by companies already operating this type of motor vehicles. Among the recent orders are the following:

Pacific Electric Railway, Los Angeles, Cal.	20
Los Angeles Railway, Los Angeles, Cal.	20
San Diego Electric Railway, San Diego, Cal.	10
Public Service Company, San Antonio, Tex.	6
Milwaukee Electric Railway & Light Company Milwaukee, Wis.	5
Trenton & Mercer County Traction Company, Trenton, N. J.	10
Public Service Railway, Newark, N. J.	25
United Electric Railways, Providence, R. I.	3
Connecticut Company, New Haven, Conn.	2
Day & Zimmermann, Public Utility Engineers, Philadelphia, Pa. (for operation in Ohio)	6

The question of delivery is becoming a serious one and orders for new coaches are now being accepted for June and July delivery. Plans for factory production in the East, however, are maturing rapidly.

It is the belief of the Fageol Motors Company that transportation is a natural monopoly subject to regulation. For that reason the company desires to encourage the purchase of Fageol coaches by the existing transportation agencies before endeavoring to develop other fields. Under no circumstances is it contemplated by the Fageol Motors Company that it should engage in the actual operation of coaches. A staff of engineers has been organized and their services are at the disposal of electric railways operating or contemplating the operation of buses. Coordinated service has been successfully worked out by several railways working in conjunction with these engineers.

Use of Variable Load Brake Is Being Extended

The recent receipt by the Westinghouse Air Brake Company of an order for the installation of variable load brakes or single-truck cars indicates a probable further extension of the use of this device. During the past two years the variable load brake has been used by street railways to an increasing extent. This attachment has the same purpose as a similar attachment added to the automatic brakes on the cars first placed in service in the Brooklyn subway in 1915. Inasmuch as surface cars do not have automatic brakes, however, the variable load attachment has been somewhat modified.

The extensive introduction of lightweight cars in city service emphasizes the need for such a device. The first property to make a large installation was the Boston Elevated, which now has more than 300 surface cars equipped in this way. The Eastern Massachusetts Street Railway, Brooklyn City Railroad, Connecticut Company, Massachusetts Northeastern Street Railway, United Railways & Electric Company of Baltimore, Union Street Railway, New Bedford, Mass. and others have equipment in service or on order. To date orders have been received for nearly 710 equipments for surface cars and about 1,000 attachments for automatic subway brakes.

Good Demand for Differential Dump Cars

Six different electric railways have recently placed orders with the Differential Car Company for dump cars and dump car trains. Of the cars ordered eight will be equipped with motors and two will be trail cars. The companies placing these orders and the type of car desired follow:

DETAILS OF RECENT DUMP CAR PURCHASES

Name of Company	No. of Cars	Type	Capacity	Motors
Tri City Railway, Davenport, Iowa	2	Motor	20 cu.yd.	GE 80-A
Memphis Street Railway, Memphis, Tenn.	1	Motor	20 cu.yd.	GE 201-I
Memphis Street Railway, Memphis, Tenn.	1	Trailer	20 cu.yd.	
Market Street Railway, San Francisco, Cal.	2	Motor	18 cu.yd.	Bodies only
Omaha & Council Bluffs Street Railway, Omaha, Neb.	1	Motor	18 cu.yd.	4 GE 80-A
New York State Railways, Syracuse, N. Y.	1	Motor	.....	4 GE 90
New York State Railways, Syracuse, N. Y.	1	Trailer	.....	.....
Cincinnati Traction Co., Cincinnati, Ohio	1	Motor	.....	4 Westinghouse 93

A majority of these dump cars are of the recently developed door-chute design.

Metal, Coal and Material Prices

Metals—New York	March 18, 1924
Copper, electrolytic, cents per lb.	13.625
Copper wire base, cents per lb.	16.375
Lead, cents per lb.	9.00
Zinc, cents per lb.	6.74
Tin, Straits, cents per lb.	53.50
Bituminous Coal, f.o.b. Mines	
Smokeless mine run, f.o.b. vessel, Hampton Roads, gross tons	$4.675
Somerset mine run, Boston, net tons	2.375
Pittsburgh mine run, Pittsburgh, net tons	2.125
Franklin, Ill., screenings, Chicago, net tons	2.00
Central, Ill., screenings, Chicago, net tons	1.70
Kansas screenings, Kansas City, net tons	2.50
Materials	
Rubber-covered wire, N. Y., No. 14, per 1,000 ft.	$6.75
Weatherproof wire base, N.Y., cents per lb	18.00
Cement, Chicago net prices, without bags.	$2.20
Linseed oil (5-bbl. lots), N. Y., per gal.	$0.95
White lead, in oil (100-lb. keg), N.Y., cents per lb., carload lots	12.25
Turpentine, (bbl. lots), N. Y., per gal.	$1.02

Officers of Johns-Manville Company Advanced

At a recent meeting of the board of directors of Johns-Manville, Inc., New York, the following officers were elected:

T. F. Manville, chairman of the board; H. E. Manville, president; L. R. Hoff, vice-president and general manager; W. R. Seigle, vice-president and general manager of the factory and mines; J. E. Meek, vice-president; J. W. Perry, vice-president; J. S. Carroll, vice-president; A. C. Hoyt, secretary and treasurer, and T. F. Manville, Jr., assistant secretary and treasurer.

The position of chairman of the board is a new office, to which T. F. Manville, formerly president and treasurer, has succeeded, while H. E. Manville, formerly vice-president and secretary, has been elected president.

James W. Perry, who was elected a vice-president of the company, is general manager of the electrical, automotive and public utilities departments. He has been connected with Johns-Manville since 1889. Mr. Perry is treasurer and a director of the Electrical Manufacturers' Council, a director of the Electrical Manufacturers' Club and has always been active in the work of the N.E.L.A., in which for five years he served as chairman of the exhibit committee. He is also a member of the American Electric Railway Association.

Foreign Trade Convention in Boston in June

The National Foreign Trade Convention will be held at Boston, June 4, 5 and 6, next. This is the first time the convention has been held in New England. The central theme of the convention will be "Our Need for Wider Markets."

This is also the first time that a session specially devoted to the interests of importers has been included in the program. It will be held in cooperation with the National Council of American Importers and Traders.

In sending the call for the convention James A. Farrell, president of the United States Steel Corporation and chairman of the National Foreign Trade Council, has cordially invited all chambers of commerce, boards of trade, national and state associations and other industrial and commercial organizations to be represented. He says that the present foreign trade situation of the United States offers an inspiration and encouragement to American foreign traders.

Rolling Stock

Binghamton Railway, Binghamton, N. Y., has decided as a result of a six months' test begun in July, 1923, to equip thirty-seven one-man cars with the Simplex Safety system.

Indiana Service Corporation, Fort Wayne, Ind., has recently ordered from the St. Louis Car Company fifteen double truck one-man cars for city operation. These cars are of the same design and construction as the fifteen cars received in October of last year. They will have double doors at the front for entrance and exit and an exit door at the rear.

Hartford & Springfield Street Railway, Warehouse Point, Conn., is negotiating for two buses.

New Orleans Public Service, Inc., New Orleans, La., recently ordered six new car bodies from the Perley A. Thomas Car Works, High Point, N. C. Delivery is to be made in ninety days. The type of body is the same as previously ordered by the Public Service Company.

United Railways, St. Louis, Mo., through its receiver is desirous of spending $1,050,000 in the construction of 100 new side-door-exit cars.

Des Moines City Railway, Des Moines, Iowa, plans the purchase of new equipment at a cost of $169,000. Three new cars are included in the purchase.

Michigan Railroad, Jackson, Mich., has placed an order for fifteen new steel frame freight trail cars and two freight motor cars.

Track and Line

Montreal Tramways, Montreal, Que., is preparing a program of extensions and improvements which will involve an expenditure of $1,500,000. A considerable part of the program consists of replacements and repairs. A new line to be constructed this year is that to give access to the top of Mount Royal. The line will be ready for operation this summer. The Iberville Street line will also be extended this season.

Community Traction Company, Toledo, Ohio, it is expected will undertake considerable track construction this summer.

Des Moines City Railway, Des Moines, Iowa, expects to submit to the city administration an improvement and extension plan which will involve the expenditure of more than $500,000. The plan includes the extension of the Sixth Avenue and Oak Park line, extension of the Sixth Avenue and Highland Park line and the extension of the Clark Street line. In addition to these improvements, the company proposals call for new tracks and paving on University Avenue at a cost of $13,622, new tracks and paving on Clark Street at a cost of $19,818 and other new tracks and paving work at a cost of $76,577. The company also plans to construct a new wye at a cost of $5,280, a new passing track and new crossovers where residents have complained of noise from the present equipment, at a cost of $3,600. The total cost of the company's proposed plan in 1924 is $717,505.

Trade Notes

Morton Manufacturing Company, Chicago, Ill., announces the appointment of the Consolidated Equipment Company, with offices at 260 St. James Street, Montreal, as its exclusive and direct representative covering the sale of its Acme line of railway appliances throughout Canada.

Mica Insulator Company, New York, N. Y., recently elected new officers. L. W. Kingsley became chairman of the board; Edward T. Wood, president, and Edward Nelson secretary and treasurer. These men have for a long time been identified with the Mica Insulator Company. The company has factories in both America and England, securing its mica direct from the mines.

New Advertising Literature

Yale & Towne Manufacturing Company, Stamford, Conn., has issued a 100-page catalog-handbook of hoisting and truck equipment. This catalog, "21-M," contains much engineering information, including a signed article by Henry R. Towne on chain block efficiency. A brief outline of the new line of Yale trucks is incorporated. The book is not for quantity distribution, but will be sent to all ELECTRIC RAILWAY JOURNAL readers making written request for a copy on their letterheads.

General Electric Company, Schenectady, N. Y., has recently issued the General Electric Review, containing a reprint from the issue of February, 1924, of an article by W. D. Bearce entitled "Epoch-Making Tests on New Passenger and Freight Locomotives." The pamphlet is illustrated.

Bethlehem Steel Company, Bethlehem, Pa., has issued an illustrated thirty-page pamphlet on Bethlehem twin-span turntables. The development of the turntables to meet the requirements of present day railroad terminal facilities is reviewed in this pamphlet.

The Electric Power Club, Cleveland, Ohio, gives important new rules on preferred ratings and system voltages for distribution transformers, standards for single-phase and three-phase step-up power transformers, the adoption of outdoor construction as standard, in the third edition of "Transformer Standards," just issued by the transformer section of the club. The new edition also contains lead markings and vector diagrams, polarity connections, standard ratings, performance specifications, tests, methods of measuring losses and temperature and all other material which appeared in the previous edition. This is a publication of forty pages and it may be obtained from manufacturers of power and distribution transformers or from the Electric Power Club, B. F. Keith Building, Cleveland.

The Field and Future of the Motor Bus has been reprinted in pamphlet form. It was the subject of a paper presented by J. A. Emery, vice-president, Ford Bacon & Davis, Inc., before the Society of Automotive Engineers at Detroit, Mich., on Jan. 24. The speech was printed in the Feb. 24 issue of *Bus Transportation.*

Triumph Electric Company, Cincinnati, Ohio, announces the issuance of a complete revision of prices, covering its entire line of motors, both a.c. and d.c., 1 to 250 hp. This price book will be issued to any user of motors who has not yet received a copy.